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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Venting and Permeability.

We are extremely indebted to Mr. E. Longden for so kindly carrying out the experiment which we asked for, the details of which are given overleaf. We can quite understand that a practical man would consider such an experiment a waste of time, but then such persons are accustomed to describe the properties under consideration in the vaguest possible language. Porosity, permeability, and venting are qualified by "excellent," "very good," "absolutely nil," and kindred expressions. Whether they can verbally transmit their ideas to a colleague is doubtful. Now, such an experiment as Mr. Longden has carried out can be understood by everybody and forms an excellent jumping-off ground. Primarily, it is established for the particular grade of sand used and rammed under conditions which are ascertainable that 3 ins. of sand was permeable. It now remains to thicken the cope and to enlarge its area to ascertain at what thickness the sand ceased to communicate with the shallowest of the vent holes. Again, a mould made exactly as Mr. Longden has designed, but vented all over 1 in. deep would prove whether there was any serious communicating between the vent holes. If so, steps could be usefully taken to separate each area.

It is interesting to note that Mr. Longden suggests "that the gases are actually percolating through the pores *very slowly*, and that the bulk of the gas which is generated rapidly as soon as the metal enters the mould takes the shortest passage, and that is into the mould cavity." This is entirely in agreement with Mr. Young's views, who insists that permeability in sand, *per se*, is of little or no importance, and that it is the "venting" which is of prime importance. Mon. Ronceray's exposition of the "effet Léonard," which relates to the venting of corners of cores which are completely surrounded by metal, is also confirmed. The cavity shown on Mr. Longden's diagram of the casting may be only another phase of "effet Léonard," but in this case the gases do not get entrained with the metal but merely cause a depression. As a result of thought on these lines, which is tending to minimise the importance of permeability, and to emphasise the necessity of artificial venting, there should result a statement as to the real importance of permeability as being an aid to the venting.

We are not inclined to agree with Mr. Longden that "moulds made with materials which do not evolve gas very little cavity and porosity would be encountered in the production of castings in grey cast iron," because many varieties of cast iron evolve much gas. We are inclining to the view that the gas content of cast iron is largely absorbed by the graphite, which is modified as to volume accordingly. By altering the cooling rate—especially retarding—and by choosing irons of short cooling ranges, the gas trouble is minimised and the graphite is left in its least harmful condition. Thus an iron of this character would require a well-vented mould, as the evolved gases would be considerable apart from the actual mould gases.

XUM

Correspondence.

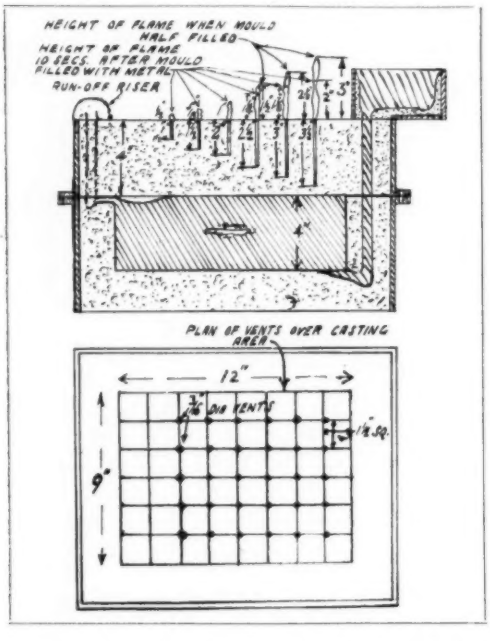
[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Permeability and Venting of Sand Moulds.

To the Editor of The Foundry Trade Journal.

Sir,—Referring to your leader on venting, etc., in the last issue of the Journal, and your suggestions relating to the possibilities of obtaining further information from an experimental block casting 12 in. × 9 in. × 4 in., and although practical foundrymen would consider it a waste of time (because they have no doubts about the real importance of venting to aid the permeability of the sands without which the production of good castings would be impossible), I have carried out the experiment suggested with the following result:—

The sketches detail and explain the experiment. Combustible gases flowed rapidly from the 3½ in. deep vent 10 seconds after commencing pouring and two seconds later, after being ignited, the flame reached a height of 3 ins. above the top of moulding box, and at the moment of complete filling of the mould, which took 35 seconds, the flame


HEIGHT OF FLAME WHEN MOULD HALF FILLED
HEIGHT OF FLAME 10 SECS. AFTER MOULD FILLED WITH METAL
RUN-OFF RISER
PLAN OF VENTS OVER CASTING AREA
12"
9"
DIA VENTS

gave a height of 4 ins. to drop to 3 ins. 10 seconds later, this height being maintained for 15 minutes when incombustible gases began to be emitted, which lasted for quite one hour. Gases which could be ignited flowed from each of the vent holes, including the one only 1 in. deep and 3 ins. from the face of the metal. Starting from the deepest vent the ignition of each row of vents occurred almost as rapidly as a lighted taper could be passed over them from right to left.

In the unvented area I suggest that the gases are actually percolating through the pores only very slowly, and that the bulk of the gas which is generated rapidly as soon as the metal enters the mould takes the shortest passage, and that is into the mould cavity. This will be more likely because of the expansion of the sand grains exposed to the metal.

It may be only a coincidence that under the unvented area cavity was found, but it is very singular, and I shall for the present use it as evidence in favour of the view stated above. I should like to point out here that I purposely omitted to have the block fed. The areas of the cavity are depicted in the sketch.

If moulds could be made commercially with materials which did not evolve gases, very little cavity and porosity would be encountered in the production of castings in grey iron.

It is well known that gases are not good conductors of heat, and that ordinary sands prolong the cooling of metals. With a view to ascertaining to what extent this happens I am carrying out experiments with various moulding sands, plumbago, ganister, etc., as moulding materials. A comparison will be made of the rate of cooling of the metal in the various materials stated.

It is to be trusted that your suggestion will be tried out by others, and that it will lead to further discussion through the medium of the Journal.

Yours, etc.,
E. Longden,
Foundry Manager,
Tangyes, Limited, Birmingham.

Cause of Blisters on Cast Iron Plates.

Sample iron plates cast from Northern American pig-irons were distributed to co-operating enamellers and also enamelled in the Bureau of Standards laboratory. Both lots of sample plates were found to blister if enamelled above a fairly definite temperature; that is, about 698 deg. C., according to "Technical News Bulletin No. 99," issued by the Bureau.

The three most probable causes of the blisters are as follows:—A certain amount of gas is taken up in the blast furnace, due to some difference in operating conditions in Northern furnaces. It has been assumed that, on remelting once in the cupola, the gas is not removed, but it is on repeated meltings. Just why this should happen is not clear, because analyses of cast irons for oxygen, hydrogen, and nitrogen show no difference between ordinary and remelted irons.

The second possibility is that some element not shown by ordinary analysis is present in the pig and is responsible for the trouble. Spectroscopic analyses fail to show any difference that can be considered significant.

The third possibility is that graphite may be present on the surface, and is not wholly removed by sand-blasting. At a sufficiently high enamelling temperature this graphite would react with the oxides of the enamel to form carbon monoxide, which causes blisters. By remelting, something might happen to change the distribution of graphite, so that finally the surface after sand-blasting would be free from graphite.

Further Tests.

In view of the possibilities sample plates were prepared from two Northern irons melted once in the electric furnace. The scrap produced was also remelted and cast into sample plates. One Northern iron has been remelted in the cupola two times and sample plates cast. The test-pieces made by the above methods have been enamelled at the Bureau, with promising results. It was found that all plates cast from the first melting in the electric furnace blistered, but not so badly when enamelled by the dry process as when enamelled by the wet process.

Sample plates obtained by remelting the scrap, both in the electric furnace and in the cupola, show no blisters when enamelled by the dry process and a decided reduction in blistering in the wet process. It appears that remelting the iron several times is beneficial in reducing the blistering of the enamel. Chemical analyses of the cupola and electric furnace melts have been made and microscopic examination is in progress.—"Iron Age."

London Foundry Extension.

Through two foundries, The Mitcham Foundry and Iron Works (Messrs. W. E. Horsman, Son and Company) and the Mitcham Foundry Company, Limited, being next door to one another in Eveline Road, Mitcham, Surrey, much misunderstanding has arisen, owing to name confusion. However, since the latter, The Mitcham Foundry Company, Limited, has gone into liquidation, the former, Messrs. W. E. Horsman, Son and Company, has bought from the liquidator the whole of the assets except the book debts. This will give Messrs. Horsman an added grey-iron capacity of 20 tons per week, together with facilities for making non-ferrous castings up to 2 cwt. and light alloy up to 30 lbs. Mr. Horsman has engaged Mr. W. Dickson as general manager over the enlarged concern.

The Adjustment of Cupola Furnaces from the Point of View of Heat Economy.*

E. Piwowarsky and F. Meyer describe in "Stahl und Eisen" for June 25 some tests they have carried out on a practical scale in a cupola furnace to determine the proper regulation of this type of furnace in order to secure the best heating effect. The tests were suggested by a Paper published in the same journal ten years ago by G. Buzek.

The actual tests were carried out at the foundry of Sulzer Brothers, Winterthur, Switzerland, where also the chemical and physical tests of all the materials used were made. The type of furnace used was a cupola with forehearth, with a diameter of melting zone of 700 mm. (about 29 in.). The diameter of the furnace increased above in the melting zone to 1,000 mm. (39 in.). There were two rows of tuyeres on the furnace, 400 mm. (15.7 in.) apart. The top row comprised eight tuyeres, each having a cross-sectional area of 75 × 75 mm. (about 3 in.) = 8 × 75 × 75 = 45,000 sq. mm. (=about 72 sq. in.). The lower row comprised four tuyeres, each 110 × 140 mm. cross-section = 4 × 15,400 = 61,600 sq. mm. (=about 95 sq. in.). The total area of blast was therefore about 190 sq. in. The ratio of blast area to melting zone area was therefore $\frac{106,600}{384,600} = 0.28$.

The entire plant is shown in Figs. 1 and 2. At the back of the furnace two measuring places were built in alongside each other at different heights. One of the places was used for determining the temperatures, the other for taking gas samples. The masonry and furnace casing were drilled through at these points and square-section cast-iron tuyere castings (3 × 3 in.) were bricked in. On the outside of these holes similar flap valves were fitted as are used with ordinary blast tuyeres. The reason for fitting the sealing flaps was that, before the blast was introduced from underneath, the measuring appliances were temporarily removed and the furnace had again to be closed from the outside.

The blast was supplied by a Sulzer high-pressure centrifugal blower.

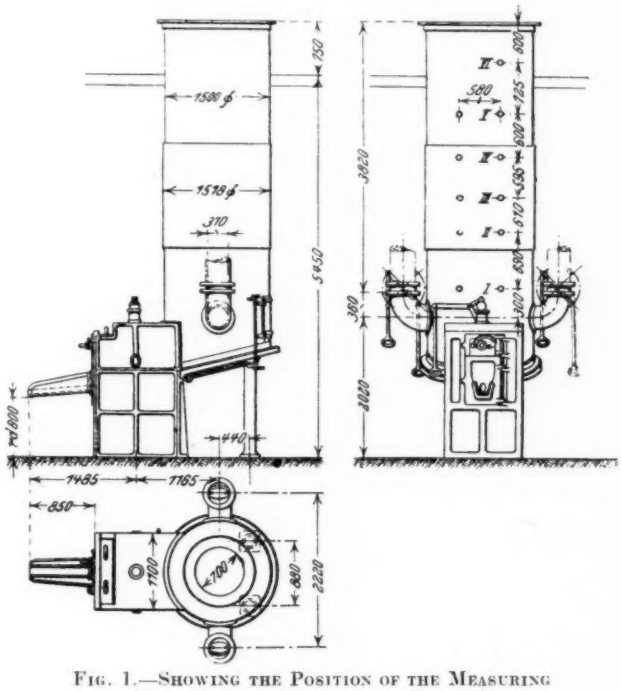


FIG. 1.—SHOWING THE POSITION OF THE MEASURING POINTS (INDICATED BY SMALL CIRCLES).

TABLE I.—*Average Composition of Gases.*

Test Series.	Test No.	Point of Measurement.														
		II.			III.			IV.			V.			VI.		
		CO_2 %	O_2 %	CO %	CO_2 %	O_2 %	CO %	CO_2 %	O_2 %	CO %	CO_2 %	O_2 %	CO %	CO_2 %	O_2 %	CO %
1	1	—	18.0	1.0	14.3	0.8	5.9	16.6	2.7	0.8	16.9	0.4	2.2	16.7	—	5.38
	2	—	15.1	0.1	17.3	0.5	0.13	18.2	1.5	0.6	17.7	0.2	1.1	16.9	0.1	6.0
	3	0.5	18.7	0.4	17.1	1.8	1.6	16.9	1.8	1.4	17.9	0.6	0.8	17.6	0.1	2.8
	4	7.9	11.3	0.4	18.5	0.5	1.6	unusable			17.4	3.9	1.0	16.7	0.1	5.9
	5	—	18.9	0.5	18.3	0.3	0.5	do.			15.8	3.5	0.7	17.5	0.2	4.8
2	6	—	19.2	0.3	17.1	1.2	1.6	17.8	1.5	0.6	17.3	0.5	0.8	18.1	—	2.2
	7	—	16.8	—	15.7	3.7	0.05	11.7	6.9	1.7	18.3	0.1	3.0	16.5	0.1	6.1
	8	—	17.8	0.1	16.9	0.07	1.6	16.9	0.4	1.8	15.9	0.04	5.8	15.3	—	7.8
	9	—	17.0	0.5	17.7	0.15	1.3	17.2	0.8	1.8	17.2	—	2.8	14.8	—	9.2
	10	—	18.4	0.4	16.3	0.2	2.7	16.8	—	3.0	15.8	—	3.5	14.5	—	9.7

At the level of the blast-tuyere a working scaffolding was erected which enabled all work to be carried out at all the points at which measurements were being made. On a second erection which was fixed up separately the measuring gear was installed, the galvanometers being fixed on a table with vibrationless suspension. The required temperature measurements were made with calibrated platinum—platinum-rhodium thermocouples and Wanner pyrometers. The gas samples were taken by means of the arrangement shown in Fig. 3.

* Translated from "Stahl und Eisen."

The measurements of the blast consumption were carried out by means of a baffle plate in conjunction with a differential pressure recorder as made by the firm of "Hydro," Düsseldorf. For the purpose of accurate calibration, the quantity meter with baffle plate was removed from the plant and built into a blast pipe in the fan testing section, and then compared with a calibrated nozzle. The blast pressure at the furnace was measured with an ordinary U-shaped resistance pipe.

The temperatures of the throat gases were measured with a graphite pyrometer, the measurement being based on the expansion of a rod of graphite. For check purposes these temperatures were compared with the indications of a thermo-couple with and without flow device.

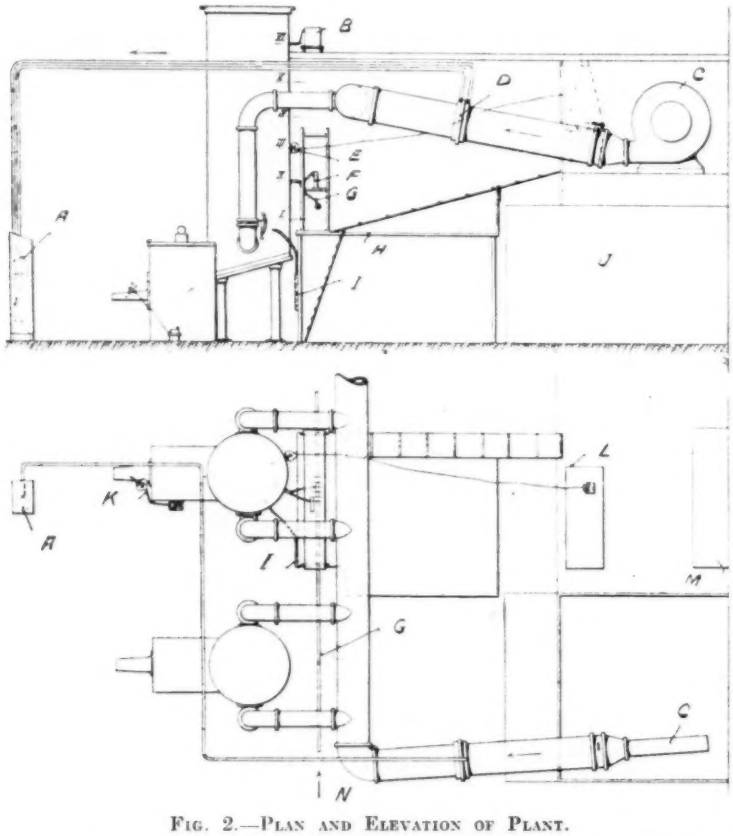


FIG. 2.—PLAN AND ELEVATION OF PLANT.

A="Hydro" blast measuring apparatus; B=Orsat's apparatus; C=Fan; D=Baffle plate; E=Thermo-couple; F=Position for gas collecting; G=Cooling air; H=Working platform; I=Blast pressure gauge; J=Diagrammatic test arrangements; K=Temperature measurement; L=Table for galvanometer; M=Table for the Orsat apparatus; and N=From the compressor.

Plan of Tests.

From previous work, extending over many months, it had been ascertained that, with the same selected burdens, the best results in the test furnace were achieved when the furnace was worked with 7.5 per cent. charge coke (corresponding to 9 per cent. total coke, *i.e.*, charge coke plus coke separated from the burden, plus bed coke consumed) with a blast consumption of 2,119 cub. ft. per min. With a coke containing 85 per cent. carbon this blast consumption practically approaches the theoretical, viz., about 2,190 cub. ft. per min. It was proposed, then, to determine the effect of quantity of blast and charge coke, so that with the same burden and the same throughput: (1) The quantity of blast introduced be varied within the widest limits of air shortage and air in excess with a constant coke charge of 7.5 per cent. (=about 9 per cent. total coke). (Test Series I, Tests 1-5). (2) Assuming a constant blast inlet of 2,119 cub. ft. a minute, the coke charge should be varied as far as possible within the limits of approximately 6.5 and 12.5 per cent. (Test Series II, Tests 6-10.)

TABLE II.—*Average Furnace Temperatures.*

Test Series.	Test No.	Temperatures in deg. C. at the points of measurement. II.	III.	IV.	V.	VI.	Remarks.
1	1	1,447	1,210	863	743	198	Quantity of coke constant.
	2	1,327	1,183	961	614	145	
	3	1,350	1,117	783	704	171	
	4	1,410	1,085	751	464	141	
	5	1,310	1,078	775	750	207	
2	6	*1,330*	1,277	902	675	180	Quantity of blast constant.
	3	*1,350*	1,117	783	704	171	
	7	*1,360*	1,260	862	768	175	
	8	*1,370*	1,288	954	749	196	
	9	*1,380*	1,355	1,235	778	297	
	10	*1,484*	1,331	931	796	283	

Charging.

The materials charged into the furnace at one time were always about 0.45 metric ton of bed coke with 0.135 metric ton of limestone. The quantity of limestone in the charge on all tests was 30 per cent. of the weight of the coke. After the topmost layer of the heating coke had been heated to red heat without the aid of artificial blast, the iron was charged, one charge of iron being 0.5 metric ton, plus the corresponding quantities of charge coke and limestone.

When changing the charges, large pieces of coke were added, so as to separate the burdens as far as possible and, if necessary, "replace" the quantity of bed coke. In the balances these additions were added to the charge coke. It would have been just the same to have counted these additions in the bed coke, as this procedure has been followed in the work of other investigators. In part, these additions burn with the charge coke, and the rest supplements the consumed bed coke.

The quantity of blast admitted was kept at the same level until the furnace was in heat, when it was slightly throttled down in order to reduce the iron losses and the reject figure and protect the furnace lining.

In all the melts, air-dried Dutch coke of uniform quality was used, and the limestone was obtained from the Swiss Jura. The analyses are as follows:—*Limestone:* SiO_2 = 2.02; $Al_2O_3 + Fe_2O_3$ = 0.63; CaO = 53.35; MgO = 1.44; loss on ignition = 42.56; SO_4 = Tr, and P_2O_5 = 0.091 per cent.

Coke: S = 1.01; Ash = 10.49; moisture content = 2.88, and fixed carbon = 85.62 per cent.

In the course of each heat the burden was changed four times, but always in the same proportions to the total run, so that, continuously,

	Si per cent.	Mn per cent.
Burden No. I contained	1.30	1.26
,, II ,,	1.82	1.11
,, III ,,	3.29	0.93
,, IV ,,	2.97	0.84

TABLE III.—*Tabulated Results.*

Test Series		Iron charged, Kilos.	Yield of iron. Kg.	Bed coke. Kg.	Charge coke. Kg.	Coke recovered Kg.	Charge coke per cent. per ton of iron.	Total coke per cent. per ton of iron.	Blast pressure. ins. of water	Quantity of blast cu. ft. per min	Proportion of CO_2 to CO.	Throat losses per cent. of total heat input. Perceptible.	Throat losses per cent. of total heat input. Latent	Thermal efficiency. %	Time of heat in mins.	Production. Tons per hr.	Tapping temperature in deg. C. Of iron.	Tapping temperature in deg. C. Of slag.
1	1	19,210	18,999	450	1,470	160	7.65	9.25	9.8	1,260	76 : 24	7.21	16.45	42.0	376	3.20	1,370	1,414
	2	22,630	22,410	450	1,720	115	7.60	9.08	12.2	1,588	74 : 26	6.61	19.7	43.8	372	3.61	1,433	1,460
	3	20,438	20,214	450	1,490	110	7.42	8.96	15.7	2,118	86 : 14	7.39	9.48	46.7	265	4.58	1,436	1,457
	4	21,130	20,898	450	1,530	80	7.24	8.99	18.1	2,259	74 : 26	7.68	22.34	44.4	280	4.48	1,440	1,468
	5	21,320	21,086	450	1,590	70	7.46	9.24	22.8	2,647	78 : 22	0.64	20.7	43.2	275	4.61	1,452	1,492
2	6	20,970	20,739	450	1,320	117	6.29	7.88	15.7	2,118	88 : 12	7.05	8.64	51.3	245	5.08	1,411	1,450
	3	20,438	20,214	450	1,490	110	7.42	8.96	15.7	2,118	86 : 14	7.39	9.48	46.7	264	4.58	1,436	1,460
	7	19,220	19,008	450	1,690	268	8.79	9.74	15.7	2,118	73 : 27	7.74	21.06	40.7	270	4.23	1,445	1,485
	8	20,160	19,938	450	2,010	182	9.36	10.51	15.7	2,118	66 : 34	7.71	26.60	35.1	310	3.86	1,438	1,461
	9	18,720	18,519	450	2,085	273	11.12	12.08	15.7	2,118	62 : 38	9.23	33.26	32.9	322	3.45	1,420	1,443
	10	20,010	19,790	450	2,480	171	12.38	13.79	15.7	2,118	60 : 40	12.23	32.44	28.8	370	3.21	1,435	1,507

TABLE IV.—*Composition of Iron Melted.*

Test No. Mixing.		TC.	Gr.	Si.	Mn.	P.	S.
1	1 ..	3.36	2.58	1.10	0.93	0.11	0.08
	2 ..	3.43	2.60	1.47	0.88	0.12	0.06
	3 ..	3.47	2.73	2.65	0.82	0.15	0.06
	4 ..	3.49	2.75	2.49	0.63	0.72	0.974
2	1 ..	3.46	2.27	1.12	0.86	0.12	0.097
	2 ..	3.49	2.41	1.42	0.88	0.11	0.065
	3 ..	3.44	2.89	2.71	0.75	0.81	0.057
	4 ..	3.48	2.65	2.61	0.64	0.69	0.070
3	1 ..	3.40	2.44	1.07	0.88	0.14	0.097
	2 ..	3.38	2.38	1.34	0.89	0.12	0.079
	3 ..	3.38	2.80	2.58	0.79	0.15	0.077
	4 ..	3.38	2.73	2.58	0.64	0.75	0.057
4	1 ..	3.45	2.50	1.16	0.90	0.14	0.09
	2 ..	3.47	2.45	1.40	0.89	0.12	0.10
	3 ..	3.42	2.76	2.64	0.84	0.16	0.008
	4 ..	3.39	2.68	2.55	0.61	0.77	0.092
5	1 ..	3.41	2.40	1.17	0.79	0.16	0.085
	2 ..	3.49	2.29	1.45	0.78	0.15	0.080
	3 ..	3.47	2.76	2.73	0.82	0.15	0.062
	4 ..	3.45	2.64	2.64	0.61	0.76	0.074
6	1 ..	3.33	2.58	1.05	0.89	0.11	0.086
	2 ..	3.36	2.59	1.34	0.79	0.10	0.075
	3 ..	3.41	2.87	2.43	0.68	0.22	0.065
	4 ..	3.39	2.89	2.38	0.70	0.69	0.060
7	1 ..	3.42	2.39	1.05	0.85	0.14	0.004
	2 ..	3.38	2.39	1.47	0.81	0.16	0.070
	3 ..	3.48	2.87	2.67	0.85	0.17	0.049
	4 ..	3.44	2.60	2.56	0.69	0.75	0.058
8	1 ..	3.43	2.45	1.12	0.91	0.10	0.100
	2 ..	3.39	2.40	1.49	0.90	0.10	0.084
	3 ..	3.40	2.73	2.61	0.83	0.15	0.059
	4 ..	—	—	—	—	—	—
9	1 ..	3.38	2.69	1.17	0.80	0.13	0.093
	2 ..	3.36	2.50	1.47	0.90	0.13	0.104
	3 ..	3.36	2.83	2.58	0.79	0.17	0.083
	4 ..	3.38	2.70	2.57	0.60	0.70	0.084
10	1 ..	3.39	2.45	1.12	0.97	0.10	0.096
	2 ..	3.38	2.57	1.40	0.80	0.13	0.107
	3 ..	3.51	2.91	2.63	0.78	0.16	0.073
	4 ..	3.35	2.73	2.60	0.58	0.73	0.087

Numerical Values Found.

The average gas composition at the several points of measurement is shown in Table I. Of course, the values included as well as the corresponding furnace temperatures contained in Table II do not enable reliable information to be obtained as to the conditions prevailing inside the furnace, especially as the wide temperature differences between the dropping coke and the iron in the cupola furnace will always remain the cause of unreliable temperature measurements even at the edge of the furnace. Taking the curves in Figs. 4 and 5, for instance, which represent the furnace temperatures at the points of measurement, one might be inclined to conclude that they were practically the same, but the figures for the point of measurement II in Tests 6 to 10 (Table II) certainly show that a relationship exists which amply coincides with the works experience as regards the increase of the iron temperatures with increasing charge coke.

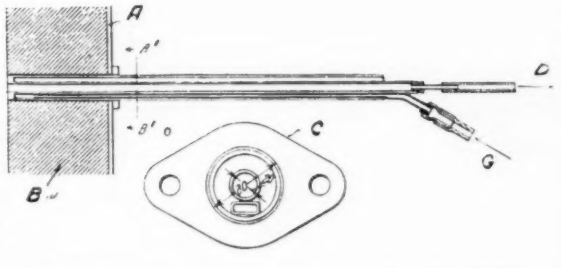


FIG. 3.—ARRANGEMENTS FOR TAKING GAS SAMPLES AT POINTS OF MEASUREMENT.

A = Furnace casing; B = Furnace lining; C = Section through A^1-B^1 enlarged; D = To the Orsat apparatus; and G = Cooling air.

Test Results.

The results of the tests, as derived from the heat balances and the other working figures, are given in Table III. These figures undoubtedly show that the coke consumption, quantity of air, thermal efficiency and yield of melt are intimately connected. The main points to notice are the following:—

(1) Where the coke charge is correctly selected, the furnace efficiency and the iron and slag temperatures decrease with decrease of air below the normal, whereas the combustion ratio and thermal efficiency are but little affected (cf. also Fig. 6).

(2) With the correct quantity of blast, but increasing excess of coke, the furnace efficiency also drops; but at the same time the ratio of carbon dioxide to carbon monoxide in the throat of the furnace, and hence the thermal efficiency also considerably fall off (Fig. 7).

An increase in the coke charge, according to conclusion (2) above, appears also to raise the temperature of the iron and slag, but the inexplicable results of the measurements in Tests 8 and 9 prevent confirmation of this point, although the temperatures of Point II in Table II bear it out.

It is also surprising that a variation in the quantity of air where the charge coke is correct has but little effect on the combustion ratio of the throat gases. This point seems of considerable import to the writers, in view of existing views as to combustibility of coke, and it may perhaps lend some support to the speculations as to the significance of the surface absorbability of coke for carbon dioxide.

The tests confirm what Geilenkirchen recently said, "that the weight of the coke charge is governed by the dimensions of a cupola furnace, especially its internal diameter," and that any excess in this charge has a much worse effect than an occasional reduction in the amount of air compared to the normal.

Table III also shows that with decreasing a coke charge the thermal efficiency and the yield of the melt increase. The utilisation of this fact is often met by the objection that losses would increase with decrease in the coke charge, and that no attempt should be made to save coke, because the cost of a heat unit produced by additional oxidation of the metal bath is many times the cost of a coke heat-unit. This idea is quite correct, but is

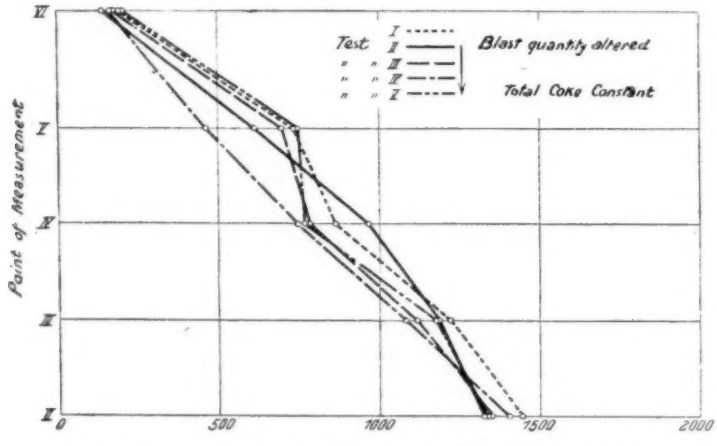


FIG. 4.—FURNACE TEMPERATURES IN TEST SERIES NO 1.

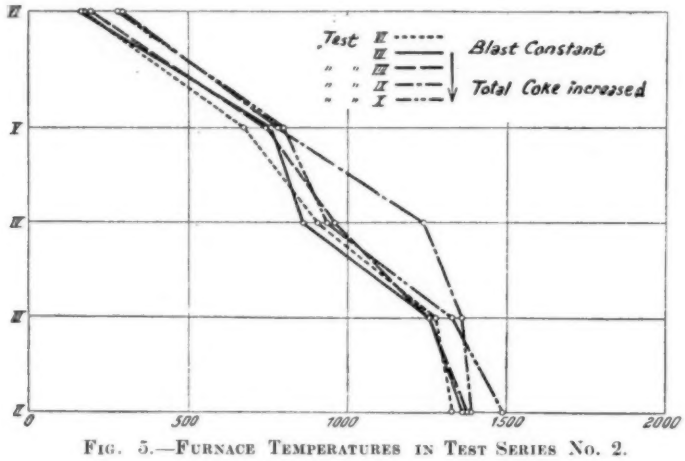


FIG. 5.—FURNACE TEMPERATURES IN TEST SERIES NO. 2.

TABLE V.—*Composition of Slags.*

Test series	Test No.	SiO_2	FeO.	MnO	Al_2O_3	CaO	MgO.	P_2O_5	S.
1	1	48.2	6.65	3.15	12.25	28.50	0.95	0.09	0.20
	2	48.89	6.73	3.19	12.02	28.07	0.96	0.12	0.28
	3	48.58	6.70	3.21	12.15	27.87	0.85	0.09	0.28
	4	50.70	5.77	3.60	12.90	25.76	0.90	0.08	0.32
	5	49.93	7.33	3.45	12.65	25.16	0.97	0.09	0.25
2	6	50.12	7.30	3.40	12.54	25.43	0.96	0.09	0.25
	7	49.10	6.80	3.50	12.25	27.04	0.95	0.10	0.30
	8	48.57	7.11	3.21	12.00	27.56	0.95	0.09	0.32
	9	49.21	6.98	3.16	12.35	26.95	0.95	0.08	0.35
	10	49.15	7.25	3.21	12.45	26.53	0.83	0.09	0.40

often taken too strictly to the letter. When one remembers that even in the ordinary methods of calculating the losses all sources of error which arise out of weighing, analysis, the surface properties of the metallic charge combine, it will be seen that too much care cannot be taken when actually evaluating the losses. With the great affinity of silicon and manganese for oxygen, the so-called chemical losses can be more correctly

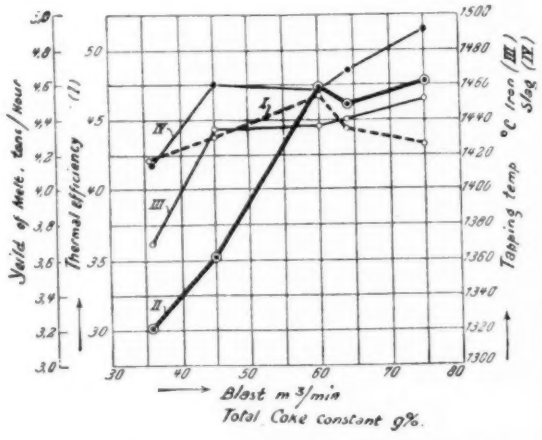


FIG. 6.—EFFICIENCY CURVES DERIVED FROM TEST SERIES NO. 1.

taken as a measure of the losses than that obtained by actual weighing. Table IV shows the average analyses of the types of iron melted in the several tests with reference to the four charges. On comparing these with the figures given above of silicon and manganese contents for the burdens, we find that only in Test 6, with 6.29 per cent. charge coke (7.88 per cent. total coke) is the silicon and manganese loss greatly in excess of the average for the other tests, that is to say, the limits between excessive losses and extravagance in the use of coke are much wider apart than is generally supposed. Even the slag compositions as per Table V (mean values of four analyses per

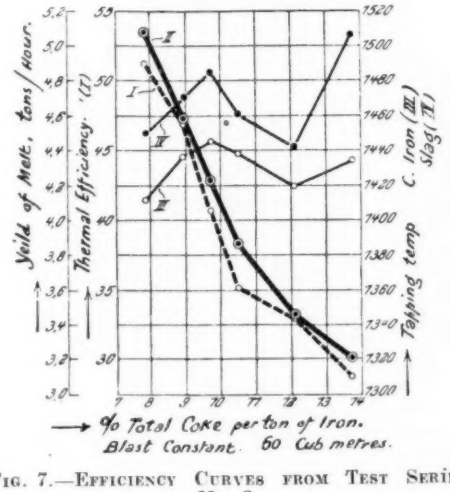

Yield of Melt, tons/hour.
Thermal Efficiency (%)
C. Iron (III) Slag (IV)
Tapping temp
% Total Coke per ton of Iron.
Blast Constant 60 Cub metres.

FIG. 7.—EFFICIENCY CURVES FROM TEST SERIES NO. 2.

melt) give no indication of the minimum permissible coke charge having been decidedly exceeded.

An attempt was also made to find some sort of connection between the mechanical properties of the melted iron and the charge coke or the quantity of air. As no such connection was found, the voluminous figures relating to these experiments are not given in the present Paper.

SUMMARY.

By means of systematic melting tests in a cupola furnace of standard pattern it was found that:—(1) It is possible to adjust a cupola furnace so as to give the best thermal efficiency compatibly with due observance of the other requirements as regards throughput and iron temperatures in the furnace; (2) in each case the consequences of an excessive coke charge are more detrimental than the consequences of too little air or a slight excess of air, and (3) the fear that a reduction in the charge coke might cause increased losses is only founded where the charge coke is below 7 per cent.

Company News.

Kynochs, Limited.—Profit, £89,069; brought forward, £329,727; dividend, 18 per cent., tax free; balance carried forward, £287,755.

Consett Spanish Ore Company, Limited.—Net revenue, £9,915; final dividend, 15 per cent., making 22½ per cent.; undivided profit now stands at £5,298.

Wellman Smith Owen Engineering Company, Limited.—Profit, £16,039; brought forward, £16,529; interim dividend, 5 per cent., less tax; no further dividend; carried forward, £19,818.

Darlington Forge, Limited.—Loss for year, after providing for interest on debenture and sinking fund, £21,764; debit balance brought in, £110,756; total debit balance, £132,520, carried forward.

Petters, Limited.—SIR ERNEST W. PETTER, presiding at the fifteenth annual meeting at Yeovil recently, said that they were suffering to an increasing extent from the scourge of unemployment, and very little was being done which went to the root of the matter and offered hope of true remedy. In his judgment there were two factors which must be dealt with before they could look for a revival in the industries of this country. The first was the stranglehold of the sheltered occupations, where the rate of wages paid was out of all proportion to that of skilled workers in engineering and other exporting industries. At the present time skilled engineers, fitters, and turners were receiving 47.3 per cent. above 1914 rates. It had been proved in protracted negotiations between representatives of employers and employees that this rate, under existing conditions, represented the maximum which the industry could pay and retain any ability to secure export orders in competition with foreign rivals. Further, it had been proved that, as a whole, the industry was able to make very little return on its capital while paying even that relatively small increase. In a table prepared by the British Engineers' Association, when giving evidence before the Government Committee on Industry and Trade, the results of thirty-one representative engineering and allied firms showed that the total amount distributed in dividends for the year 1923 was less than 5 per cent. on the paid-up capital of those companies. Of those thirty one companies, eleven paid no dividend at all on their ordinary shares. It might, therefore, be taken that 47.3 per cent. over 1914 represented the maximum increase in wages which this country could afford when subjected to foreign competition. In the sheltered occupations, however, not directly exposed to the keen wind of foreign competition, but in the end equally concerned, because they had to be carried by the exporting industries, wages had advanced to a much greater extent. For instance, railway porters' wages, when compared with 1914, had increased 130 per cent.; dockers, 144 per cent.; Post Office wages, 114 per cent.; police constables, 133 per cent.; municipal labourers, 137 to 146 per cent.; certificated teachers, 140 to 164 per cent. The burden of the increases, all of which were well over 100 per cent., had to be borne by an industry employing in many cases much more highly skilled workers which could with difficulty pay only 47.3 per cent. increase over 1914.

The Emmel Thyssen Process.—We are informed by the International Foundry Equipment Company, 132, Steelhouse Lane, Birmingham, that they are acting on behalf of the inventors of the Emmel Thyssen process of making high-duty cast-iron so far as Great Britain and the Colonies are concerned. The tests derived from this material were outlined in an article by Hubert Hermanns in our last issue. A party of British foundry men are visiting the Ruhr district in the near future for the purpose of examining the process.

Blast Furnace for Los Angeles.—There is an abundance of iron ore of good quality in California, but coke or coking coal would have to be brought from a considerable distance either by rail or by water. There is at present no coke blast furnace on the Pacific Coast, the nearest stack being that of the Columbia Steel Corporation at Provo, Utah, which was completed about a year ago. There is a scheme under consideration to erect a coke blast furnace at Los Angeles or vicinity, on the completion of an investigation now under way.

A Binocular Magnifier.

Hitherto microscopical observations have been confined to the laboratory, where specimens have to be prepared before such observations can be made. For scientific research and experimental work the laboratory is the one and only place for conducting such observation. But there is certainly room for an instrument which will enable

Fig. 1.—Examination of Metals under Binocular Magnifier.

comparative examinations to be made by the foundry manager, the coke-oven manager, and indeed, all those engaged in the iron and kindred industries.

For the purpose of what we may term comparative examination, a high power of magnification is not so necessary as a considerable depth of focus and a large field of view. The Binocular Magnifier illustrated, designed and manufactured by Messrs Ogilvy & Company, of 20, Mortimer Street, London, W.1, appears to meet in a very satisfactory manner the requirements referred to above. By the adaptation of various sizes of stands almost any size of specimen, such for example as a broken pig, can be brought within the range of the instrument; the bodies are standardised and are therefore interchangeable with any size of stand.

Fig. 2.—Examination of Large Specimen under Binocular Magnifier.

The body is designed on the principle of the prismatic binocular with very short-focus lenses and exceptionally long working distance, provided with coarse and fine focussing. The magnifications are changed by changing the eye-pieces only and not the objectives. Three sets of eye-pieces are supplied, giving magnifications from 3½ diameters up to 30 diameters.

Commercial Steels.

(*Continued from page* 122.)

Chrome-Silicon Steels.

At one time chromium and silicon were used as an alloy spring steel with the silicon about 1 per cent., but this steel did not come into general use, silicon being thought unreliable. Recent investigations have, however, shown that the principal trouble with silicon when alloyed with chromium, or chromium and molybdenum, has been popular prejudice. Silicon when incorrectly alloyed with iron and carbon produces brittleness, but when alloying elements such as chromium, molybdenum and nickel are employed, the silicon adds materially to toughness, easy workability and reliability.

The usual straight chromium steel of high or low chrome content carries the chromium in the form of carbide if there is sufficient carbon. Chromium does not form a chemical compound with the iron, but is present in the alloy, probably in the form of a finely divided mechanical mixture or solution. If there is sufficient carbon present all the chromium will be found in the form of chrome carbide.

If silicon is added to chrome steel of high or low carbon, quite a different metal is produced. Silicon has a great affinity for chromium and iron, forming a chemical compound known as silicide—iron silicide or chrome silicide. In this chemical form it is neither chromium nor silicon. The silicides are readily dissolvable in iron, probably forming another chemical compound, which does not separate out into isolated areas of variable concentrations.

It has been known for a long time that silicon readily dissolves in iron, and has never been recognised out of chemical solution with the iron. Areas of high concentration are known as silicides, but not silicon. With silicon one is able to use chromium in iron, employing the full properties and imparting to the iron qualities that are not entirely similar to those of chromium and iron, though in some instances they are related.

Chrome silicon steels or irons are naturally harder than those low in silicon; they take on a peculiar metalloidal temper, as it were, of their own. They have excellent wear-resisting properties, the surface readily glazing and imparting great surface hardness. This is of infinitesimal thickness, and does not detract in any way from the physical properties of the alloy.

Chrome silicon alloys of high or low carbon are very strong and tough, and, unlike alloy steels generally, remain tough as the temperature is raised. Ordinarily, steels lose their toughness as the temperature is raised under a red heat. High chrome silicon steels and irons are the outcome of research in rustless steels and irons, and they represent far-reaching developments.

It has long been recognised that silicon increases the physical strength of steel, though imparting so-called brittleness by raising the elastic limit and of necessity lowering the stretch, *i.e.*, elongation and reduction of area. There are certain outstanding examples of silicon steels which are exceptionally tough; for instance, silico-manganese steel, a steel high in silicon but with the usual manganese.

The element silicon holds gas in steel in solution, and only takes out the excess gas; hence, though it is considered an excellent deoxidiser, it is only a partial deoxidiser. The gas that is held in the steel has given a great deal of trouble and perhaps is responsible for some of the bad reputation that silicon has had. If silicon is used as an alloy in iron and steel, and treated as an alloy, and not used as an alloy and de-gasifier combined, it is possible to develop some very interesting and wonderful properties in silicon combination alloy steels.

Organisation of the Castings Store.

By W. J. Hiscox.

The necessity for a well-organised castings store is not always recognised in the engineering works where foundry work is "carried out on the premises," and as a consequence there is often delay and confusion arising out of inaccurate records and faulty routine.

In such a works the bulk of the castings are usually made for stock, but there is also a number of special requirements, definitely associated with specific customers' orders. In regard to the standard castings, it is essential that adequate stocks are maintained, and this is possible only when the records can be relied upon. In connection with the special castings, it is necessary for their whereabouts to be known, and although the foundry may be able to show that a specific casting was completed on a certain date, it is not able to show where the casting is at the moment. The reader may protest that this is outside the sphere of the foundry department, but the responsibility must lie with someone to show to whom the casting has been delivered.

FOUNDRY ORDER.

Casting Stores Copy.

DATE *27 June, 1925.* ORDER NO. *1416.*

Supply Castings as under:—

Quantity.	Pattern No.	Material.	Required for	Use Pattern
100	*K25*	*CI*	*Stock*	*K25*

Delivery { Commence / Complete *2 weeks.*

FIG. 1.

The matter is dealt with by the establishment of a castings store, but there are often so many leakages that very little improvement is shown. In some works this store exists simply for the stock castings, special castings being delivered direct from the foundry to the machining department, and this very often leads to trouble. In another works the special casting is received in the castings store, and remains there pending receipt of a requisition. As in practically every instance the special casting is urgently wanted, delay often occurs by this procedure, and it seems to be better, therefore, for the storekeeper to take the initiative, thus obviating any semblance of delay.

In regard to the stocks of standard castings, these must be maintained at a sufficiently high level to cater for the demand, and it is a serious matter when the machining department is held up for supplies. Most delays in this respect are occasioned by the late issue of orders on the foundry department, due to the absence of reliable data concerning the state of the stocks.

It is very well for the works manager to set his face against additional expense, but he does not always understand that "economy" in one direction will lead to excessive waste in another. If he has not yet established a castings store, he will do well to put the matter in hand without delay, for the relatively small expense associated with this will be more than covered by the saving effected elsewhere.

In most works, however, the castings store is already in evidence, and it is only a question of adopting a reliable procedure in order to obtain efficiency. It costs no more to run a department efficiently than it does to run it upon more or less haphazard lines, and if the routine is established upon somewhat similar lines to the proposals given below it will be found that no extra expense is involved, but that the value of the department is enhanced.

In the first place, it must be definitely understood by all concerned that every casting (whether standard or special) must leave the foundry *via* the castings store, and that when once the casting is accepted by the storekeeper its subsequent whereabouts are of no concern to the foundry officials. To ensure that no casting can get out of the foundry save by this channel, the castings store should be between the foundry and the machining departments, if possible adjoining the foundry.

The castings storekeeper should receive a copy of every order issued on the foundry (Fig. 1), so that he knows precisely what he has to expect. It is obvious that, should a foundry order be subsequently cancelled or amended, the storekeeper's copy should be treated likewise.

Upon receipt of an order for castings, the following routine should be handled by the storekeeper. Every order when received is entered in a book (see Fig. 2), so that all orders appear normally in consecutive order. This book has columns for the order number, date of order, quantity of castings, pattern number, and whether special or standard, and these columns are filled in by the storekeeper immediately each order is received. The two final columns, showing (*a*) when the completed castings are received in the store from the foundry, and (*b*) when the castings are issued from the store to the machining department, are, of course, not utilised until these events occur. It may be explained that the entries in these two columns denote the completion of the order in each instance; that is to say, if the order covers 100 castings, and deliveries are made thus, 30, 25, 40 and 5, the entry coincides with the receipt (or issue) of the last delivery.

Immediately after a record of the new order is made in the book (Fig. 2) the storekeeper makes a record of all *stock* orders upon a castings stock

ORDERS ISSUED ON FOUNDRY.

Order No.	Dated.	Quantity.	Pattern No.	Special or Std.	Completed.	
					In.	Out.
1419	*26/6/25*	*500*	*K18*	*Std.*		
1416	*27/6/25*	*100*	*K25*	*Std.*		
1420	"	*1*	*FB1*	*Spl.*	*29/6/25*	*29/6/25*
1437	*29/6/25*	*5*	*YB6*	*Spl.*		
1451	*30/6/25*	*100*	*K6*	*Std.*		

FIG. 2.

card (see Fig. 3). These cards are filed under the pattern number in consecutive order, and each gives information relating to new orders received, castings received from the foundry, and castings issued for machining, in connection with one specific pattern number. At this juncture the only entries appear in the columns under the heading of "orders received."

There is no card record relating to special castings, but the orders for these are filed under the order number (consecutively) pending receipt of the castings from the foundry. Orders for stock castings are similarly filed after the entry has been made upon the card record.

When special castings are received from the foundry the corresponding order is referred to, and if the number received is less than the number covered by the order brief particulars are marked upon the order, and the castings retained pending the arrival of others to complete, unless a special call is made by the machining department for a

part delivery, in which case the castings are issued upon receipt of a requisition, which requisition is attached to the order. When the number of castings received from the foundry equals the number covered by the order, the storekeeper does not wait for a call, but straightway issues, demanding a requisition from the foreman of the department concerned. The necessary entries are made in the two final columns of the book (Fig. 2), and the completed order (with the requisition attached) is sent to the ordering department, and a receipt obtained.

It is not often that stock castings are delivered from the foundry in quantities large enough to complete an order, but as each delivery is made an entry is made on the castings stock card (Fig. 3), under the heading of "Castings from Foundry." When a stock order is completed the same procedure is observed as that just described in connection with special castings, excepting that the castings are held in stock until specifically called for.

Issues of stock castings are made upon a requisition from the machining department, each issue being recorded upon the castings stock card (Fig. 3) under the heading of "Castings Issued." The quantity shown upon a requisition has no relation to the quantity covered by one specific foundry order; for example, the foundry order may cover 500 castings, whilst not more than 100 are drawn out upon any requisition, or there may be three foundry orders, each covering 50 castings, and one requisition covering 120 castings. Once stock castings are received in the store they are dissociated from their several foundry orders, so far as issuing is concerned. All requisitions, when cleared, are sent to the costing department.

There is a note upon every castings stock card to the effect that when the supply of castings falls below a given figure the ordering department must be notified, the supply denoting not only the castings actually in stock, but also those yet to come from the foundry, off uncompleted orders. This enables the ordering department to place further orders early enough to obviate delay in the future. The storekeeper is not expected to urge the foundry for supplies; if he cannot meet a requisition he returns it, and it is then the business of the progress man to urge the foundry.

Under this scheme all castings are delivered to the storekeeper by the foundry, and all stock castings are drawn from the store by the machine shop labourers. It is only the special castings that the storekeeper delivers, and it will be found that the working of the proposals will not prove arduous to any intelligent man.

CASTINGS STOCK CARD.

Advise Order Dept. when available.

Castings (including those on Foundry Orders) are below *50*. Pattern No. *K25*.

Orders Received.			Castings from Foundry.			Castings Issued.			
Order No.	Date.	Quantity.	Date.	Quantity.	Total.	Date.	Reqn. No.	Quantity.	Total.
15/1301	*26/4/25*	*100*	*3/5/25*	*20*	*20*	*10/5/25*	*X73*	*25*	*25*
			4/5/25	*25*	*45*	*20/6/25*	*X109*	*25*	*50*
			7/5/25	*35*	*80*	*23/6/25*	*XT117*	*10*	*60*
			30/5/25	*20*	*100*				
1416	*27/6/25*	*100*							

Fig. 3.

There were only two launches from Sunderland shipyards during the month of July, these being the ss. "Anglo-Indian," 5,500 gross tons, built by Short Bros., and the ss. "Solon," 4,560 tons gross tons, constructed by W. Gray & Company. This makes a total output for the month of 10,060 gross tons, and brings the total tonnage launched during the seven months of the year up to 16 vessels, aggregating 63,676 gross tons. During the corresponding period of last year the output was 39 ships and 131,523 gross tons, but for the seven months of 1923 the launches were only 11, and the total gross tonnage 31,601. Two orders have recently been booked, one by Short Bros. for a vessel of 9,000 tons, while the other has been secured by W. Pickersgill & Sons, and is for a vessel of about 8,000 tons. This ship is to be engined with turbines by Parsons' Marine Steam Turbine Company, Limited, of Wallsend.

The Selling of Castings.—XVI.

By Voyageur.

Advertisements can be divided into two parts, the text and the design or "lay-out." The essentials of a good casting-advertisement are five in number:—(*a*) Power of attracting attention; (*b*) power of arousing interest; (*c*) power of convincing the reader; (*d*) power of creating a desire to try or purchase, and (*e*) power to induce immediate action.

Undoubtedly (*a*) is largely a matter of good design or lay-out, whilst (*b*) depends upon the character of the text. A good headline is of great importance. The specific is always better than the general remark. Such weak and uninspiring headlines as "Economy and Quality," "Blank's Castings are the Best," and so forth, are useless. As examples of advertisements that fulfil requirements in their headlines one may quote:—

"Eight castings that were not required"; "Ten per cent. higher tensile than the inspector thought possible"; "An output of 300 tons of castings per week." Each of these makes the reader want to know more.

After the bright and specific headline in importance comes the first sentence of the text itself. This should never be a general remark. One casting-manufacturer who writes his own advertisements always deletes the first sentence of any advertisement he writes. He says that having set him going, it has served its purpose, and is never worth retaining. This sort of opening: "The buyer of aluminium castings must carefully weigh the advantages of trustworthy performance" should be cut out without remorse. It merely bores the reader, and effectually stops him from reading on. Always be specific, never general. Facts are more important than mere opinions.

Facts (*c*) alone carry conviction to the reader. The castings, whatever their seeming lack of special characteristics, should be studied closely, in order that potential arguments in their favour may be discovered. Five sources for selling-points exist:—(*a*) The castings themselves, and what they will do or save; (*b*) what the castings will not do or cannot be used for; (*c*) the man who uses the castings; (*d*) the performance of the castings (*i.e.*, actual facts and figures), and (*e*) the man who sells the castings.

A detailed study of the product will reveal many arguments that have been overlooked. It must be remembered that what is obvious to the founder is not always so to the purchaser, who is often completely ignorant of what to the former seem widely-known facts. From the raw materials of which the casting is composed down to the laboratory in which each cast is analysed and tested, arguments in favour of the castings can be drawn. Nothing should be passed over as unimportant.

Sometimes talking-points can be obtained from what the castings will not do; *e.g.*, the great argument for manganese steel castings is not that they are cheaper or better in themselves, but that they do not wear out so quickly as those of ordinary steel. Sometimes, also, what appears to be a disadvantage can be turned into a selling-argument. Thus, the fact that managnese steel is non-magnetic has rendered castings made from it specially suitable for certain parts of electrical machinery.

Sales-arguments can be obtained frequently from customers. Their expectations of the castings, the uses to which they put them, the way in which they handle them, and so forth, all offer opportunities for effective and convincing proof of the

castings' fitness for their work. Authentic testimonials concerning the length of service given by the goods, their capacity to stand up under heavy conditions, and so forth, are valuable food for advertisements.

Again, the man who sells the castings will often have information in his possession that will strengthen the advertisements considerably. He knows just what arguments he finds most convincing in his efforts to obtain orders.

Creating a desire to try or purchase the castings (*d*) is entirely dependent upon the essential worth of the castings themselves, the reputation of the founder, and upon the personal skill of the man who has the job of writing the advertisement-text. It must be borne in mind that one cannot make a man crave for castings as one can make him crave for a gramophone, or a valve-set or a new hat. Yet the craft of the advertisement-writer is all the more necessary for this very reason. He has to do more with less material to work upon. Therefore, a trained copy-writer should be employed by every founder, if he can possibly afford it. The essence of advertising castings is argument: sound, logical, concise argument, well stocked with facts and figures of a genuine and irrefutable kind.

To induce action (*e*), to which end every advertisement should be written, there are several expedients. The announcement may invite the reader to send for a catalogue or pamphlet; it may make a special offer of an advantageous kind; it may ask the prospective purchaser to supply information concerning his requirements, in order that free advice may be offered him; it may boldly press for orders; it may suggest a visit to an exhibition at which the castings are being displayed. But whatever the means adopted of getting the reader to write to the founder, something should be done to establish contact. The request-form or coupon is, as has already been mentioned, one way of doing this, and it is a very effective and simple way. Another way is to run a line of italic type across the foot of the advertisement, suggesting action of the sort desired (*e.g.*, *Write for our free booklet*). Sometimes a hint of this kind is enclosed in a little square or rectangle. But these are all mere technical tricks to make the reader take some action as a result of reading the advertisement. They are useful, because ultimately they give the founder the names of people interested in his goods, and enable him to circularise them or to send his travellers to call upon them.

But the prime incentive to action is the text of the advertisement itself. No technical dodge can make a customer take action if he has not first of all been impressed and influenced by the arguments in the body of the announcement.

The design of casting-advertisements should be restrained, dignified, and neat. Vulgarity, loudness, ugliness, should be avoided. Half-tone blocks should be of a screen suitable to the paper of the journal in which they are to appear. Nothing is more unsightly than a block too fine for the paper that carries its impression. Block-makers will recommend a suitable screen if supplied with a sample of the paper. Avoid ridiculous attempts at originality, such as printing an advertisement upside down, or with the type set at odd angles. Do not use white lettering on a black background. It is not so legible as black on white, and it seldom prints well. Avoid heavy lines of capital letters. These also have been proved less legible than ordinary type, which has a proportion of small letters. In addition they are unsightly, and spoil the balance of the advertisement, thus weakening its appeal to the eye. Do not employ underlines to emphasise any word or sentence. They make an announcement spotty, and are unnecessary. Italics should be employed for purposes of emphasis, if essential.

Illustrations should actually illustrate, not be stuck in for the mere sake of the thing. Their description should be set underneath them, so that even if the text is not read, the description of the illustration may be, and so convey a message. If the text is long, break it up by inserting sub-titles. Small type should be made more readily legible by breaking it up into two parallel columns, thus making the line-length smaller, and preventing the eye from tiring. The types chosen should be uniform, not jumbled and mixed. Caslon is a serviceable kind of type for all purposes.

A Permanent Mould Development.

Realising that cold cast-iron moulds chill the castings and that untreated hot ones cause "stickers," Mr. Hubert A. Myers devised a process for the continuous utilisation of the latter. The process consists in treating the mould with a low temperature volatilising metal, such as zinc, cadmium or magnesium. Of these, zinc is preferred on account of cheapness and the readiness with which it is absorbed by the iron. After pickling, the moulds are impregnated with powdered zinc by heating the two together for 12 hours at 480 deg. C., and as a result each time that the mould is used a certain amount of the zinc is volatilised, which is said effectually to prevent any interfusion between the mould and the casting. The process is being used in the works of the H. S. Lee Foundry & Machine Company, Plymouth, Michigan, U.S.A.

London Metal Exchange Rules.

The directors of the London Metal Exchange have approved of the following rules, proposed by the Committee of Subscribers:—

COPPER BRANDS.—All dealings in the ring for refined or rough copper must be for a brand deliverable as standard copper under the official list of the Metal Exchange.

LEAD DECLARATIONS.—Original declarations of shipment from ports other than Continental or English ports must be made at least five days before the due date of arrival of steamer. Declarations of shipment from Continental or English ports must be made at least two days before the due date of arrival of steamer.

LEAD AND SPELTER DECLARATIONS.—Time received and time sent out must be filled in, otherwise the declaration is not valid. Any firm not passing on a declaration immediately will be liable for any charges that may be incurred as a result of such delay.

Special Rules for Lead and Spelter.

OPTIONS CLAUSE.—On and after September 1 next, on all contracts for options on spelter, notice is to be given on the first market day of the month, and in the case of contracts for options on lead, notice is to be given on the 9th day of the month or the nearest market day thereto.

ARRIVAL CLAUSE.—Should the whole or any portion of the lead or spelter for which the steamer's name has been declared to buyer against a contract be lost on the voyage, and not come forward by any other vessel or vessels on seller's account, the quantity not coming forward shall be considered as having been delivered and paid for, except that the seller shall on such quantity pay to or receive from the buyer any difference between the contract price and the settlement price of the market day preceding the day on which the original declaration was sent out, such difference to be paid within seven days of the declared loss.

MR. J. GRAHAM GILLAM, Iddesleigh House, Caxton Street, Westminster, S.W.1, has been appointed London agent for the Kelvin Construction Company, Limited, Glasgow; Thomas Walmsley & Sons, Limited, Bolton, and Ornastele, Limited, Swansea; and British agent for the A.E.G. Metallwerke Oberspree, Berlin.

ANSHAN IRONWORKS.—According to the "Kokumin," the Anshan Ironworks, subsidised by the South Manchuria Railway Company, have proved disappointing as a business proposition. At one time the business caused the company a yearly loss of four million yen. Then Viscount Ogochi, after studying the situation on the spot, drew up plans, a partial execution of which curtailed the loss to two millions a year. But the completion of Viscount Ogochi's programme, which seems largely to consist in the abandonment of operations in the small workings, will not allow the business to pay its way, but will still cause the South Manchuria Railway a yearly loss of a million yen. At the same time, the company has invested 60 million yen in the undertaking and is not prepared to go on losing, especially as trade depression is telling on its finance. After careful discussion of the subject between the Vice-President of the Railway and the Chief Secretary of the Cabinet it has been decided that a solution of the difficulty lies in efficiency of operation rather than the winding up of the business. In consequence, Viscount Ogochi has been invited to proceed to Manchuria to start investigations again with a view to securing higher technical efficiency in the ironworks.

A Quantity Production Method of Making Syphon Castings.

By J. H. List.

The object of this article is to show a reliable method of making return bends in moderate quantities, which, however, must be such as will pay for the making of special tackle, such as box parts. The job is suitable for a machine, but it does not follow that because a machine is not available the design and arrangements of the box parts should in any way suffer. There are many quantity jobs which could be carried out quicker if proper box parts were provided, in spite of the fact that they may have to be made on the floor, because a machine is not available. In either case, however, the number must be such that the faster output will cover the cost of the necessary tackle. It is assumed the job is to be done on a machine. It can be mounted on a jar ramming, pattern-drawing machine, or a hand-ramming, pattern-drawing machine, but in any case there must be a pattern-drawing mechanism. The work should be arranged with a stripping plate. It is well-known that if the pattern has a well-finished surface, a stripping plate is apparently superfluous.

Though this is true, it should be borne in mind that a stripping plate is so cheaply incorporated, that its use will discount any doubt as to the pattern's finish, and insure a clean draw. The stripping plate may be run round the pattern in white metal, or it may be cut out in three-ply wood, both methods being insignificant so far as cost is concerned in relation to the rest of the tackle. When fitting the stripping plate to the pattern it is necessary to have a good clearance, otherwise trouble will be experienced through the sand binding between the pattern and the stripping plate. In most jobs of this nature, there is provided an excellent pattern with a stripping plate; a good core box; well-machined, jointed box-parts, and well-fitting pins, but invariably the most important point, that of the securing of the core in position, is sadly neglected. As is well-known some jobs call for more attention to the coring up than the actual mould making. In this particular job, unless good arrangements are made, the coring up will take much more time than the making of the mould.

The box-parts must be made to suit the job, only allowing the minimum amount of jointing round the pattern, and to be as shallow as possible, that is not more than 2 ins. of sand above the highest point of the pattern. This apparent smallness is due to the fact that the boxes have to be lifted off the machine table, and therefore lightness is desirable. The parts should have a centre bar cut out to fit round the pattern closely, and the top part to have a boss cast in, in the centre of the bar 2 ins. deep.

Making the Bottom Part.

For part of its support the core will rest in the two prints, but it will also require support midway, depending on the size of the syphon. If of a small bore a perforated stud just placed on the mould will be found sufficient, but if the diameter of the syphon is fairly large it will be found that the weight of the core will push the stud into the mould.

In this case it is necessary, when ramming up this part of the mould, to place a square lump of iron, say, 1½ in. × ½ in. thick on the pattern. This would form a sort of foundation upon which to lay the perforated stud. This method practically takes no time, whereas if a chaplet be used it would be necessary to drive in a wooden block, and then the chaplet has to be driven in according to a depth gauge, whereas complete ranges of perforated studs are obtainable to definite thicknesses and thus eliminating gauging.

Making the Top Part.

The middle bar having the boss cast-on centrally is drilled and tapped out to ⅜ in. Whitworth thread, and a set pin is fitted with the head downwards. When set, a locking nut is screwed on to fix the pin permanently. It must be fixed so as to give the correct thickness, that is, the distance from the box joint to the underside of the head must be equal to half the outside diameter of the syphon plus any lump that is to be put on the pattern to form the extra metal for riveting the pin after it has been cut off in the fettling shop. The underside of the set pin will thus come in contact with the lump on the pattern, when the top part of the moulding box is put on. This is clearly shown in the section through the mould in Fig. 1. After the joints of the cast-iron core box have been machined, a hole to clear a ⅜ in. dia. pin must be drilled exactly in the centre, so as to coincide with the setpin fixed in the top-part of moulding box. When making the core, a pin ⅜ in. dia. is inserted in this hole, always making sure that the hole is quite clear to enable the pin to fit in properly. This pin must be sufficiently long to rest on the core iron thus ensuring a firm foundation, enabling it to withstand the strain of the molten metal.

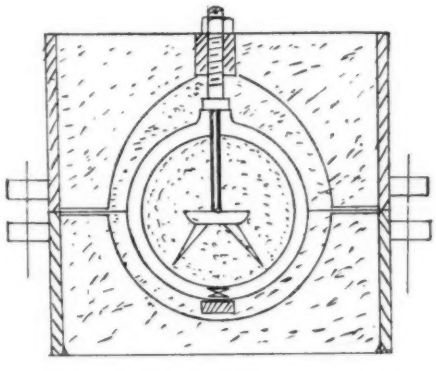


Fig. 1.—Section through the Mould.

No further staying is required for the core in the top half. The underside of the head of the ¾-in. set pin, when the top box is placed on in position, exactly coincides with the ⅜-in. pin placed in the core. This arrangement is only satisfactory if the core box, when making the core, fits exactly face to face, for if it does not, and the core becomes too large, and when the top is put on a crush results. To overcome this difficulty the core box, when having the ⅜ hole drilled to receive the pin, it is left a little shallow, in order to equal the small amount of sand that may get between the joint of the core box.

Patent Specifications.

Particulars of complete specifications accepted, furnished by Mr. Eric Potter, Patent Agent, of Lonsdale Chambers, 27, Chancery Lane, London, W.C.2. Printed copies of the specifications in the following list are now on sale.

236,739. Hamilton, W. B., and Reid, F. Process of reducing metal oxide.

236,794. Beardsley, E. D., and Piper, W. F. Machines for making sand moulds.

225,501. Lanz, H. Process for the manufacture of high quality grey cast iron.

236,677. Calvert, A. W. Furnaces for detinning metal plates or other articles or surfaces coated with block tin or other like material.

236,999. Hamson, B. M. W. Method and apparatus for grinding threaded members, such as taps, etc. April 14, 1924.

237,005. British Thomson Houston Company, Limited, and Kingwell, K.F. Machines for bending and shaping wire, etc. April 15, 1924.

237,112. Griffiths, H. A., and Griffiths, R. H. Cutting, drawing, etc., presses for operating on metal sheets or strips. Aug. 14, 1924.

237,149. Martin, J. W. Rolling mills. Nov. 18, 1924.

228,131. Nathorst, H. J. H. Roller grinding mills. Jan. 26, 1924. Addition to 225,239.

228,131. Naamlooze Vennootschap Phillips Gloeilampen Fabrieken. Manufacture of bodies from metal having a high melting point. Jan. 24, 1924. Addition to 200,879.

Steel Castings.*

By W. J. Corbett.

The American steel casting industry is divided into two general divisions: (1) The manufacture of railway castings, such as couplers, side-frames, bolsters, etc., for railway cars; and (2) the manufacture of all other castings, generally classed as miscellaneous. The first-named division is highly specialised, and its product is of a repetitive nature. The division devoted to the manufacture of miscellaneous castings is of the opposite nature, and its product is widely diversified both in size and design, thereby placing it in the class of industry doing a jobbing business. The number of companies producing railway specialties is relatively few compared with the number making miscellaneous steel castings; but on the other hand, the average size of the former and the average output of these foundries in tonnage of castings are much in excess of the latter.

Since the manufacture of railway specialty castings is really a separate industry in contradistinction to the manufacture of miscellaneous steel castings, the principal purpose of this Paper will be to deal with the latter, which is of more general public interest than the former whose product is confined chiefly to use in a single major industry.

There are two main classes of foundries producing miscellaneous steel castings; one making castings of large and medium sizes having metal sections varying in thickness from ½ in. up; and the other making small castings having thinner sections. The manufacture of large castings involves the use of facilities differing from those used in making small castings. The amount of floor space must be considerably greater, and there must be an adequate system of overhead crane transportation to move the moulds and castings. Large ovens for drying the moulds must also be provided. The furnaces for making steel and for heat-treating the castings must be considerably larger than are necessary in the case of small castings. In addition, there must be a large investment in massive flask equipment for moulding the various sizes and shapes of the numerous patterns from which castings are made.

Steel-Making Equipment.

Three types of melting furnaces are used in American steel foundries; namely, open-hearth, electric and converter. The open-hearth furnace is the melting medium in steel foundries making miscellaneous castings of large and medium size, and in steel foundries designed solely for making railway specialties. The basic-lined open-hearth furnace is used practically exclusively in the latter, while the acid-lined furnace is used in almost every foundry using the open-hearth process for miscellaneous castings. The capacities of these furnaces vary from 5 to 40 tons, the smaller units being used for making castings of medium and small size. Steel can be made at a lower cost in open-hearth furnaces than in converters and electric furnaces.

The use of the electric-arc furnace and the converter is generally restricted to the manufacture of small castings. This is their logical field, due to the ability to make very hot metal in smaller quantities than is practicable with the use of the open-hearth furnace. Small castings having sections as thin as three-sixteenths of an inch require very fluid steel to pour them.

Although hot steel can be made in the open-hearth, it is usually impracticable to attain the temperature possible in the other types of melting units, on account of the rapid deterioration of the walls and roof. Furthermore, the heats from the electric furnace and converter, which are 2 or 3 tons in size, are smaller than those made in the open-hearth furnace, and can be poured more quickly into the moulds, thereby minimising the loss in temperature and fluidity of metal held in the ladle. Converters as well as most of the electric arc furnaces used in steel foundries are lined with acid refractory material.

The electric furnace is to a great extent displacing the converter in the steel-casting industry, as will be seen by reference to Table I, which is based on figures compiled annually by the American Iron and Steel Institute. There are perhaps two reasons for this: one being that it is possible to regularly make better steel in the electric furnace; the other being that the steel can normally be made in many localities at a lower cost in the electric furnace than it can be made in the converter. The initial cost of an electric furnace installation is many times that of a converter and cupola. The melting loss in the converter is generally from 15 to 20 per cent. of the scrap metal and pig-iron used, whereas this loss is only about 5 per cent. of the metal charged into the electric furnace. Of course, the local cost of electric power has an important influence on the actual difference in the cost of making steel for castings by the two processes.

TABLE I.—*Annual Production of Steel Castings by Different Melting Processes in Percentage of Total Production of All Processes.*

Year.	Open-hearth furnace.			Electric furnace.	Converter.	Crucible.
	Basic.	Acid.	Total.			
1913 ..	45.1	44.2	89.3	0.90	7.89	1.72
1914 ..	48.3	38.9	87.2	1.23	9.50	1.61
1915 ..	38.4	46.4	84.8	2.66	10.66	1.70
1916 ..	44.2	41.6	85.8	3.12	10.40	0.68
1917 ..	38.8	45.5	84.3	4.50	11.04	0.27
1918 ..	35.9	44.9	80.8	7.67	11.40	0.09
1919 ..	32.2	46.0	78.2	11.43	10.11	0.10
1920 ..	35.6	43.1	78.7	12.41	8.38	0.14
1921 ..	39.0	38.6	77.6	15.22	6.94	0.13
1922 ..	41.1	39.3	80.4	14.97	4.61	0.11
1923 ..	39.2	39.9	79.1	16.85	4.63	0.13

There is a certain point in the monthly tonnage output curve where the cost of operating any electric furnace mounts rapidly and becomes very much greater than the cost of operating any converter. This condition is due to the fixed monthly demand charge for power, which is a considerable sum that the foundry must pay, whether the monthly output of steel is 100 tons or 500 tons. During the fluctuations in the demand for steel castings by consumers, there are corresponding fluctuations in the output of the foundry, and when the latter reaches a certain point in periods of depressed business the cost of making steel in an electric furnace becomes very high.

Some persons who are not familiar with the steel industry believe that all metal made in an electric furnace is better than that made in the other melting media, and that the metallurgical control of the electric furnace is comparatively simple. Hence, they have the erroneous idea that steel castings made in foundries using the electric furnace for melting steel are always superior to the castings made by the other steel-making processes. These beliefs cannot be substantiated by observance of the practical operations in manufacturing steel castings. The making of good steel for castings in the electric furnace requires as much metallurgical skill as do the other processes of making steel.

Foundry Practice.

While it is essential in the manufacture of steel castings that the steel be of good quality, there are other details of foundry practice of as much or even greater significance. A poor grade of steel poured into moulds used for forming castings nullifies all the care and skill used in the other operations in the foundry; and conversely, the best steel that can be made will not produce good castings unless careful consideration has been given to other important details.

The design of the casting and the pattern equipment to be furnished by the customer are two very important factors in the production of good cast-

* Abstract of a Paper read before the American Iron and Steel Institute at New York. The author is Assistant Director of the Electric Steel Founders' Research Group, Chicago, Ill.

ings, which neither the consumer nor the producer can afford to disregard. Sometimes the design of a casting is such as to prevent making it in an economical manner, either because it would cause great losses in the way of defective castings, or because the pattern equipment cannot be constructed in a way to permit rapid production. Alterations in designs without affecting the utility of the castings frequently overcome these difficulties. It is advisable to consult an experienced steel foundryman in regard to casting design, as he can often suggest changes that will result in savings to the user, either in the initial cost of the castings or in the assembling and machining operations at the customer's plant.

Many of the troubles encountered in making the castings or in machining and assembling them at customers' plants are traced directly to the use of unsuitable pattern equipment in the foundry. These difficulties could be eliminated to a great extent if consumers of castings would obtain the ideas of foundrymen previous to making the patterns and core boxes. The customer pays for the pattern equipment and its maintenance, whether it is made by the foundry or by the customer. Sometimes there are disadvantages in having the foundry make the patterns and core boxes. Even when this is the case, it is desirable for the consumer to obtain the recommendations of the foundry before having such equipment made.

The moulding and core sand of highly refractory material must be carefully selected and mixed with the proper amount of clay or farinaceous material to provide the bond or cohesiveness necessary to make the mixture retain its moulded shape when worked in moulds and cores. Proper sand mixtures are especially important in making steel castings having smooth surfaces and freedom from sand inclusions. When castings are made in green sand, that is, in moulds not dried before pouring steel into them, great care must be exercised in using a moulding sand mixture of such characteristics that there will be no cutting action of the steel on the mould surfaces, and no tendency of the gas formed from the moisture and other ingredients in the sand to form blowholes in the castings. Green-sand moulds are used in most cases for making castings of small and medium sizes whose sections are not heavy. Larger castings having heavier section are made in moulds that have been baked or dried to eliminate the moisture. Hence, it is not so essential to have as accurate daily control of the sand mixtures used for dry-sand moulds as it is for green-sand moulds, although careful attention has to be given the former at all times. This control pertains particularly to moisture content, cohesiveness, and permeability, for which standard testing methods have been devised within the last few years by the Joint Committee on Moulding Sand Research.

The use of chills, fillets, and brackets, and the size, shape, and location of heads (or risers) and gates on castings have much influence on the making of satisfactory steel castings. Inexperience and carelessness in observance of these details cause many defects. The contraction of steel must be fully understood if such defects as cracks and shrinkage holes are to be prevented. No definite rules in regard to these can be established for application in every case, as each design of casting presents a separate problem, requiring individual attention on the part of the foundryman, who has even resorted to the X-ray in some cases to detect hidden defects, and aid him in improving his moulding practice.

The cleaning of steel castings after they have been shaken out of the moulds is another item of major importance included among the many complexities in steel-foundry practice. Few people have a clear conception of the effort expended in preparing steel castings for delivery. Even such an apparently simple operation as shaking castings out of moulds demands the exercise of judgment in many instances. After this operation has been performed, there are many others through which the castings must pass, such as sand-blasting, chipping, removing heads and gates, grinding, welding, heat-treating, and inspection. Each of these requires a considerable expenditure for specialised labour.

During recent years, steel foundrymen have devoted considerable attention to the heat-treatment of their product. Not so long ago this operation was performed in a rather haphazard fashion in many foundries without proper regard for temperature control and the time necessary to obtain the desired grain refinement of the metal. Now, all progressive steel foundries aim to develop the best combination of strength and ductility in their castings by careful regulation of the heat-treating operation.

Cost of Making Steel Castings.

There are three main elements in the cost of making steel castings; namely, steel, labour, and indirect or overhead expense. These are not of equal significance: consequently, a fluctuation in the price status of one element produces an effect on the total production cost only commensurate with its relative importance. The cost of labour is the most important element entering into the total cost of making miscellaneous steel castings, and is very much greater than it is in many other manufacturing industries. The cost of the metal may vary from 10 to 45 per cent. of the total average cost of operating a steel foundry. The percentage of the total cost of castings represented by the cost of steel depends on the designs of the casting. Hence, it is obvious that the weight of a casting is not the governing factor in its total cost per pound. Even in the case of castings having the same weight but having different designs, the cost of steel alone may be different for each, due to the differences in their yields, meaning the percentages of the total amount of steel melted and poured into them that are represented by the amount of steel in the finished castings. The yield of good castings in percentage of the metal melted may vary from 30 to 80 per cent., depending on design.

The cost of labour and the indirect expense or overhead are more important factors in making steel castings than is the cost of the steel, and these elements of cost are not the same for all castings. They vary with the designs of the castings as well as with their weights. However, the latter are not so essential as the former, because the total cost per pound is not necessarily the same for castings having the same weights. A casting whose weight is 100 lbs. may cost two or three times as much to make as another casting whose weight is the same, due to the difference in their designs which necessitate the expenditure of different amounts of labour and indirect expense in making them.

A significant item of expense is that of defective castings. The expense attributed to this item is variable with the nature of the castings, although the total average amount of castings scrapped in the foundry may be from 5 to 15 per cent. of all the castings produced.

Some producers and consumers of cast-steel products consider them in terms of tonnage in the same way as steel ingots, rails, etc.; that is, a group of steel castings of miscellaneous designs is looked upon as a certain number of tons of steel. The fallacy of this is apparent when we stop to analyse the making of steel castings and find that they are manufactured articles requiring the expenditure of a large amount of labour, and that the cost of the steel in them is generally small compared with the cost of the labour performed on them.

Use of Steel Castings.

Due to the progress made in the manufacture of steel castings, much machine work on built-up parts to make them suitable for assembly can be reduced or eliminated by using steel castings that are in many cases of complex designs. Parts re-designed for cast steel can frequently be made lighter in weight without sacrificing strength, due to the ability to make cored recesses or pockets of various shapes in the castings. Economy can be effected in some places by re-designing parts previously made of grey iron or malleable iron, in order that they can be made of cast steel, thereby securing greater strength with the added advantage of decreased weight.

The modern engineer should make his selection of forged steel, cast steel, malleable iron, or grey iron for any part to be designed in the light of some general information regarding the progress made and the present state of the art in the manufacture of these materials. Each has its useful field of application. All factors, including appearance, weight, machine cost, strength, ductility, and

expense of maintenance and replacement, should be carefully considered. It is not always easy to hastily form a sound conclusion regarding some of these elements of final cost. In the case of forgings, the expense attached to the manufacture of and investment in dies must be taken into consideration quite as fully as the expense of machining a forged part of simple or intricate design.

Co-operative Research.

An interesting development in the American steel casting industry in recent years is the formation of the Electric Steel Founders' Research Group, which consists of five separate companies making small steel castings. Each of those companies is distinctly separate from the others so far as ownership is concerned. They organised for co-operation in their industrial efforts, and have pooled their talents to improve the quality of their product, and to eliminate unnecessary expenditure. When the Group was formed in 1920, each member company pledged its organisation to co-operative research, freely offered to all the members the results of independent investigations, and agreed that there should be no hesitation in exchanging data. Obviously, these basic requirements implied confidence, unselfishness, altruism, and broad vision on the part of the executives of the companies. The research investigations of the group are conducted at the different plants in accordance with mutual arrangements concerning the specific studies to be made at these plants. A central laboratory is not maintained, as it is found more expedient to carry on the researches at the plants where practical conditions obtain.

The direct results of the co-operative efforts of this research group, as well as those to be obtained by all well-planned research work in any company or industry, may be summarised as the following :— (1) Improvement of present products and processes, and development of new products and processes. (2) Development of new uses for known products. (3) Standardisation of quality of products, manufacturing operations and methods of analysis and control. (4) Elimination of waste and, therefore, reduction of costs.

Supply and Demand.

The steel-casting industry in the States has a producing capacity considerably in excess of the demand for its product, as will be seen by Table II.

TABLE II.—*Orders for Steel Castings in Percentage of Producing Capacity.*

Year.	Miscellaneous castings.	Railway specialty castings.
1915 ..	73.9	66.3
1916 ..	92.7	122.8
1917 ..	96.7	67.7
1918 ..	100.3	106.0
1919 ..	46.3	25.4
1920 ..	67.6	69.2
1921 ..	24.6	25.0
1922 ..	54.9	86.9
1923 ..	72.8	77.0
1924 ..	55.8	75.3

The figures in this table were compiled by the U.S. Department of Commerce, which issues a bulletin showing the orders for steel castings booked each month. The significant feature of the data in the table is that in only one year in the last decade were the orders for miscellaneous steel castings equal in amount to the capacity of the foundries making this class of work. This was during the war in 1918, when there was an excessive demand for all kinds of manufactured products. Since the period of war-time inflation, the demand for steel castings has fallen far short of the steel-foundry capacity in the United States. Even during the period of brisk business in 1923, it was only about 73 per cent. of the capacity of that branch of the industry making miscellaneous castings.

The making of steel castings may appear to be reasonably free from complications, to those inexperienced in the business. It actually requires a high degree of skill, and involves many phases of engineering. Some foundries have started in business with the illusion that an electric furnace alone would be the means for making high-grade steel castings at a profit. To make good electric furnace steel requires more than a furnace, a pile of cheap scrap, and a man to pull switches. Carefully selected steel scrap must be obtained, and the steel-making operations must be controlled by an experienced metallurgist if satisfactory results are to be obtained. Even when the owners of electric furnaces have spent considerable time in learning how to make good steel, they have only solved one of the problems in making satisfactory steel castings. There are many phases of foundry practice, apart from melting, each of which has an important influence on the quality of the castings and on the cost of the product. The control of every factor involved in making high-grade steel castings presents a task that calls for experience, technical knowledge, ingenuity, and business judgment, all of the highest degree.

Development of the American Pacific Coast Steel Industry.*

Under the auspices of the California Development Association and the Los Angeles and San Francisco Chamber of Commerce, the first California steel industry conference was held at Del Monte recently. In furtherance of the projected development of the steel industry on the Pacific Coast, an executive committee was elected, the first meeting of which was fixed for March 6. Resolutions were passed calling for (*a*) the co-ordination of all steel-industry groups and agencies of California for the most effective development of the steel industry of the Pacific Coast; (*b*) the formulation of a programme to obtain the purchasing policy of buyers of steel products in California to support California, Pacific Coast and American steel products; (*c*) the formulation of a plan to reduce foreign imports of steel products in California to a minimum; (*d*) the formulation of a plan for the complete survey of the steel industry of California, for the developments of new markets, the ascertaining of facts about the tariff on steel products with a view of obtaining just protection, and for the purpose of gathering data on production and consumption of steel products for use in forecasting future developments of the industry; (*e*) the formulation of plans for the encouragement of new industrial enterprises in California; and (*f*) the formulation of a plan to obtain the active participation of other interested States on the Pacific Coast and in the West in these developments.

MR. MAYNARD MCFIE (chairman of the Conference), in an introductory address, stressed the importance of a broader and more intensive development of the Pacific Coast steel industry, and deprecated any idea that they were "legislating against Eastern mills."

MR. WIGGINTON E. CREED (president of the Pacific Gas & Electric Company, and of the Columbia Steel Corporation) stated that five of the seven Western rolling mills were in California, one in Utah and one in Washington. The steel industry of the West had been a natural evolution, a natural growth to meet the local demand. Before the war only a few bars and small shapes were rolled, and the mills were dependent on scrap. The war changed all that, and the need for raw materials and pig-iron resulted in the opening of the first blast furnace in the West during 1924 at Provo, Utah. The pig-iron produced was now being used in the open-hearth furnaces, and mill capacities had expanded. The past year had witnessed the opening of two sheet mills, a wire mill and a nail mill, and the progress of the past few years was a significant portent of what the future held for the steel industry of the West.

MR. W. U. JACKSON, of White Lodge, Tettenhall, has died at the age of fifty-three years. Mr. Jackson became managing director of the Weldless Steel Tube Company, Limited, Wednesfield, in 1899, and on the death in 1920 of the chairman (Mr. F. Z. Lloyd) he was elected to that position. For reasons of health he relinquished both offices in 1924.

* Abstracted from "The Iron Age."

The Improved Hurst Oil-Fired Receiver.

The modern tendency in all iron-foundry practice, whether in the grey-iron branch or in the malleable branch, is towards the adoption of metal having low total-carbon contents. For the production of high-grade cast iron the accepted use of such low total-carbon contents is one of the most important developments in the general practice of the foundry industry.

Adjustment of Practice for Making Low Carbon Cast Iron.

The difficulty of the production of low total-carbon content metal from the cupola is fully appreciated by all foundrymen, and arises from two distinct causes. Firstly, the rapid tendency for the molten iron to absorb carbon from the contact with the coke and carbonaceous gases makes it impossible to obtain low total-carbon contents with assured and systematic regularity. Secondly, when such low total-carbon content irons are obtained it is necessary that they should be cast at a higher temperature than normally used. A sufficiently high casting temperature is difficult to obtain from the ordinary cupola.

It is well known that the major portion of the carbon absorption takes place whilst the iron is lying amongst the bed coke in the cupola, and low total-carbon contents in iron can be consistently obtained by eliminating the well of the cupola almost entirely and substituting a fore-hearth or receiver. This method prevents the metal from lying in contact with the bed coke in the hearth of the cupola for any length of time, and as a result a low total-carbon content material is collected in the receiver. This, of course, only applies under those conditions in which a low total-carbon content mixture or a semi-steel mixture is charged into the cupola.

The drawback to this system of using an ordinary forehearth or receiver is the fact that no provision is made for ensuring the casting temperature being sufficiently high as to enable successful results to be obtained; in fact, if anything, there is a danger of the casting temperature being somewhat lower when using a receiver or forehearth of this type.

The Hurst oil-fired receiver was designed some years ago to meet the requirements of the production of low total-carbon content irons, suitably hot and of accurate composition. This receiver has been previously described in "The Engineer," March 31, 1922, and in The Foundry Trade Journal (vol. 25, page 331), and has been in practically continuous operation at the author's works for the past four years. Certain improvements have been recently introduced with the object of securing still more efficient superheating with a more economical use of fuel, and patents have been applied for these improvements.

Recent Improvements.

The receiver as in use is illustrated in Fig. 1. The receiver is shown adapted to an ordinary cupola of 2 to 3 tons per hour capacity. The oil burners of the low-pressure air type, using air from the cupola blast mains, and crude oil of the Anglo-Mex type, are so arranged that the hot gases are directed over the surface of the molten metal collected in the hearth of the receiver and on to the stream of molten metal as it issues from the cupola into the receiver. Outlet ports are also provided at various levels in the wall of the receiver adjacent to the cupola, which register with similar ports provided in the cupola wall, as shown in the diagram, Fig. 2. These outlet ports are provided with firebrick dampers, so that the hot gases and flames can be led into the melting zone or above the melting zone of the cupola as desired. The gases and flames can also be diverted through ports provided in the receiver wall in such a manner that they can be used for preheating the oil and air supplied to the burners.

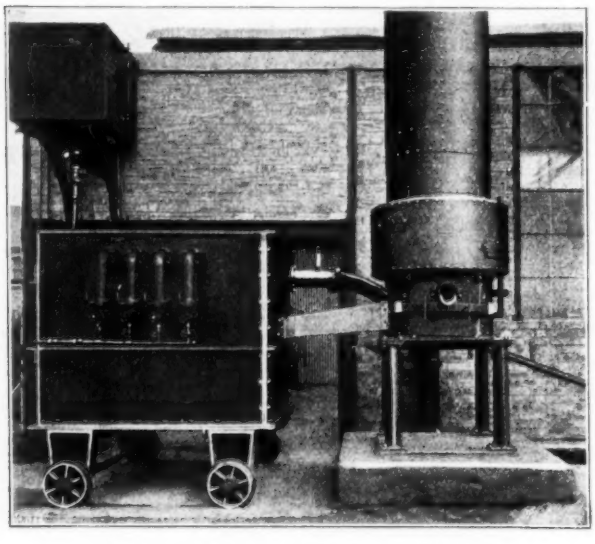


Fig. 1.—The Hurst Oil-fired Receiver.

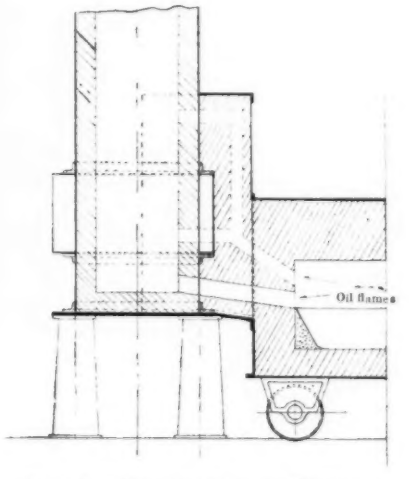


Fig. 2.—Arrangement of Receiver.

Under these conditions the molten metal flowing into the receiver in the form of a thin stream is subjected to the intensity of the oil flames. The oil flames are continually playing over the surface of the molten metal in the bath, maintaining the superheat imparted to the metal as it enters the receiver.

The hot gases and flames pass up the stack of the cupola, adding their quota of heat to the contents of the cupola. By this means hotter initial melting is secured and the heat from the oil flames fully utilised.

Additions in the form of ferro-alloys and pig-iron with the object of modifying the composition of comparatively small quantities of metal for special purposes can be readily performed in this type of receiver. Desulphurisation, using chlorides, fluorides, soda ash, or manganic oxide additions, can also be effected in this type of receiver. For this purpose it is necessary to prevent the slag entering the receiver. This can be done by inserting a baffle brick in the passage between the cupola and the metal, diverting the slag floating on the surface of the metal, which is run off at an intermediate slag notch.

In designing the form of oil-fired receiver for this purpose, it has been realised that the melting of iron with coke in a cupola furnace is the cheapest form of initial melting of iron that can possibly be obtained. For this reason it is obvious that if cupola melting can be retained as the initial method of melting and superheating and subsequently applied to such cupola-melted metal, then the superheated metal is obtained in the cheapest possible manner.

Maintaining Iron Fluid.

The receiver illustrated is designed to hold from two to three tons of molten metal. Four oil burners of the low-pressure type, supplied with oil from an elevated tank, are arranged as shown in Fig. 1. Air at 20-in. water gauge and Anglo-Mex fuel oil (Sp. Gr. 0.940) are used. In actual operation the full complement of burners are used to raise the temperature sufficiently high to receive the molten metal. Starting from dead cold, this takes from 40 to 60 minutes, but with the receiver in regular use this initial heating period is reduced from 20 to 30 minutes. When the receiver is sufficiently hot, the cupola is started and the molten metal collected in the receiver. The burners can then be gradually closed down, and under conditions of regular operation one burner is sufficient to continue the operation of the receiver. With this burner system it will be apparent that any adjustment can be made according to the demands of the foundry. As an example of the utility of this system during experimental periods there has repeatedly been held and maintained as small a quantity as 10 cwt. of molten metal at a perfect casting temperature for periods of one to two hours.

The receiver is mounted on wheels to facilitate repairing, and a breast-plate provided, held in position by the tapping spout, to enable the fettling of the furnace to be carried out after each day's cast.

Oil Consumption.

The average oil consumption is from 5 to 8 galls. per hour, using Shell-Mex (Sp. gr. 0.940), including the oil used in the starting-up period, operating over a total casting period of six hours per day. The actual oil consumption per ton obviously depends upon the tonnage of metal handled during this period.

The use of this type of receiver attached to a cupola without any collecting well allows of the metal being conducted away from the cupola without any prolonged contact with the bed coke. Rich semi-steel mixtures melted under these conditions can be collected in the receiver and the total carbon maintained as low as 2.50 per cent. Melting all-steel scrap together with some ferro-silicon, proportional to a silicon content of 0.5 per cent. in the final metal, with rapid melting in the cupola metal, as low as 2 per cent. total carbon was collected in the receiver and maintained sufficiently hot for casting.

This is the basis of the system for the production of low total-carbon content irons, both for malleable and grey iron foundry requirements.

In the ordinary way this is most successfully done in open-hearth furnaces, and this type of furnace has been adopted in several foundries for this purpose. From the general foundry point of view the open-hearth furnace has several serious defects. The heavy initial capital expenditure required for the installation of such furnaces is probably the most important. The second important defect is the lack of flexibility of open-hearth furnaces. This makes itself apparent in a variety of ways; for example, the difficulty of providing for continuous casting, the difficulty of operating with small quantities, the expense incurred by operating one shift only daily.

The oil-fired receiver allows of all the advantages of the open-hearth method being acquired at a low initial capital cost, at a much cheaper cost of melting, and enables these advantages to be obtained when operating in small units with exactly the same degree of flexibility as with an ordinary cupola.

Iron and Steel in Chile.—The report of the French concern, Hauts Fourneaux, Forges et Aciéries du Chile, states that the Chilean Parliament has passed a new Act, under which increased bounties are to be paid on pig-iron and steel made by concerns newly established in the country. The output of iron ore from Tofo during 1924 reached 1,074,773 tons, thus exceeding the minimum provided for in the agreement with the Bethlehem Corporation of the United States. Two 20,000-ton steamers have been added to the fleet, which will enable ore exports to be increased considerably.

Oxidation and Deoxidisers.

BY "VALLISHE."

It has been generally acknowledged that a large percentage of brass and copper castings are rendered either totally defective or very unsatisfactory through no other cause than oxidisation. Oxidation shows itself on the casting in the form of gas holes, spongy places, and hard spots of copper oxide. During recent years, care has been taken during the melting operation to reduce this oxidisation by covering the molten metal with a thin layer of powdered charcoal. By this method no further oxidisation will take place, but what about oxidisation that may have been taking place before this stage? For high-grade castings, a more positive method must thus be employed, that is in the form of deoxidisers. For castings of low conductivity, the deoxidiser may be either silicon of phosphorus. It may here be stressed that whatever form of deoxidiser is used, great care must be taken to see that it is free from any moisture before being introduced, or the result will be a violent spattering of the molten metal.

Silicon as a Deoxidising Agent.

In copper, brass and bronze castings it is extremely beneficial both to the strength and to the homogeneity of the casting that as much of the occluded gases, arising from the absorption of oxygen, be removed as possible. An alloy of copper, *i.e.*, 4 to 5 parts of silicon and 90 to 95 parts of copper, is often used for this purpose. The reason for this mixture is owing to the greater affinity of oxygen for silicon than for copper, the oxygen in the metal uniting with the silicon and forming a silicate which can be skimmed off on rising to the surface. The addition of about 1½ lbs. of this alloy to 100 lbs. of copper is reputed to produce good, sound copper castings. Were this not done, much trouble would arise from blowholes, due to the presence of occluded gases. It is, however, of extreme importance that the correct amount of silicon be added, so that none will be left over when the oxides are fluxed off. On adding to the molten metal, stir well with a long rod so as to bring as much as possible of the copper in contact with the flux. It should be well noted that this is practically a refining process.

Phosphorus.

The use of phosphorus as a deoxidising agent is well known, the oxygen combining with it and passing off in the form of a yellowish-white smoke. It is usual to store sticks of phosphorus (about 2 oz. each in weight) in a sealed bottle containing water, as phosphorus will ignite at a temperature of 40 deg. C., and if exposed to the air will take fire naturally. Special means must then be provided for putting it into the metal. Several methods of dealing with this are now in use, one of them being to put the phosphorus in a tube made of graphite, and having a ⅝-in. hole extending through it. A metal rod is then inserted, and the sticks of phosphorus held in the tube by fastening strips of tin or copper over the end. The tube is then put into the molten metal and held there until all the phosphorus is absorbed.

Some founders, however, "prepare" the phosphorus so that it can be safely handled for a number of seconds. This is done by placing the sticks in diluted sulphate of copper for about half an hour, and thus depositing a copper coating on the sticks. On taking the sticks from the stone jar containing the solution, they should be placed on blotting paper, resting on wire netting, suitably supported in a form of square pan containing water. It is advisable that the pan be provided with an airtight cover, for use in case the phosphorus should take fire. This latter method, however, of handling is not recommended, as during this method much of the phosphorus is oxidised and lost and there is always great danger of a very nasty burn.

Aluminium.

Pure aluminium alloyed with about 90 per cent. of copper is a deoxidising agent which greatly increases the strength of a casting. It has, however, one great disadvantage in that it greatly increases the shrinkage to such an extent, that

for castings containing 10 per cent. aluminium it is a very difficult matter to get good results. If aluminium is used by itself, it oxidises whilst in contact with the air and forms a thin coating of aluminium-oxide on the top of the molten metal. This, of course, will render a casting defective if allowed to pass into the mould. This is a serious objection, and more so, as the film forms so quickly that it can be easily seen with the naked eye, forming on a hitherto clean stream of metal as soon as it is poured out of the crucible.

Boron.

For castings of high-conductivity, boron should always be the deoxidising agent. Silicon, phosphorus, etc., are totally unsuitable for such castings, as they readily combine with copper and remain in the metal. It is necessary that the deoxidisation be performed by a substance which readily combines with the oxygen, yet without combining with the copper. Boron is an element possessing both these features. In its pure form boron is too costly for the average foundry, but it may be obtained at a much cheaper rate in the form of boron suboxide. The proportion of the mixture should be:—for every 100 lbs. of copper in the crucible, add about 1¼ lbs. of boron suboxide. Good results are obtained by placing the powder in the bottom of the crucible and pouring the molten metal on to it. If ordinary copper is used, the "boronised" casting may have a conductivity as high as 97 per cent., pure annealed copper being about 100 per cent. Boronising costs from ¾d. to ½d. per lb. of metal treated. The casting is ideal from a machining point of view and generally has a tensile strength of about 23,500 lbs. per sq. in. The elongation is 30 per cent. on a length of 3 in. by 0.799 in. dia. The use of boron (or boron suboxide) is steadily gaining favour on account of the excellent results obtained; though the cost of production may be slightly increased the high standard of the finished article is a sure means of obtaining good sales and repeat orders.

American Foundrymen's Association.

Syracuse Convention Programme.

The following Papers and Reports are expected to be submitted:—

"The Advantages of Recuperation in Connection with High Temperature," by Col. H. D. Savage.

"Brass Foundry Problems," by Mr. F. L. Wolf.

"Some Refractory Problems in the Non-Ferrous Electric Furnace Casting Shop," by Mr. G. F. Hughes.

"Temperature Control of Non-Ferrous Alloys," by Mr. R. L. Binney

"Melting Cast Iron in the Electric Furnace," by Mr. G. E. Lamb.

"Continuous Iron Temperature Recorder on the Cupola Spout," by Messrs. H. W. Dietert and W. M. Myler.

"Mechanical and Physical Properties of Grey Cast Iron and Semi-Steel," by Mr. O. W. Potter. Paper contributed by The Twin City Foundrymen's Association.

"Some Inter-Relationships in Cast Iron, Wrought Iron and Steel Practice," by Mr. J. E. Fletcher, British Cast Iron Research Association. Annual Exchange Paper of the Institute of British Foundrymen.

"Carbon Steel and Carbon-Vanadium Steel in the Converter," by Mr. S. R. Robinson.

Report of Committee on Specifications for Steel Castings.

"Cleaning Steel and Malleable Castings," by Mr. J. H. Hopp. Contributed on behalf of the Chicago Foundrymen's Club.

"Low Cost in Electric Furnace Melting," by Messrs. A. W. Gregg and H. R. Knox.

"Aluminium Alloys for Air Craft," by Mr. S. Daniels.

"Aluminium Alloys," by M. de Fleury, Paris. Exchange Paper of the Association Technique de Fonderie de France.

"Mechanical Properties of the Aluminium-Copper-Silicon Alloy as Sand Cast and as Heat Treated," by Messrs. Samuel Daniels and D. M. Waner.

Report of Committee on Non-Ferrous Metals.

"Aluminium-Alloy Permanent Mould Castings," by Mr. J. B. Chaffee, jun.

Luncheon, Round-table Discussion.

Brass Foundry Topics, Informal Discussion of Problems.

Apprentice Training Section.

Discussion of questions and experiences of apprentice training.

Foundry Refractories.

Discussion of questions of foundry refractories.

Steel Foundry Practice.

"Steel Foundry Management," by Mr. J. D. Towne.

"Making Miscellaneous Castings for Navy Use," by Lieutenant-Commander D. F. Ducey.

Report of A.F.A. Representation on Joint Investigation of Effect of Phosphorus and Sulphur in Steel.

Report of Committee on Heat Treatment of Ferrous Metals.

Report of Committee on Corrosion.

Report of Joint Committee on Pattern Standardisation.

"Safety in the Foundry," by Mr. R. G. Adair. Contributed on behalf of the Ohio State Foundrymen's Association.

"Foundry Management," by Mr. Barrett.

Report of Chairman of Joint Committee on Moulding-Sand Research.

Report of Chairman of Sub-Committee on Testing Foundry Sand.

Report of Chairman of Sub-Committee on Grading Foundry Sands.

Report of Chairman of Sub-Committee on Conservation and Reclamation of Foundry Sands.

"A Novel Method of Tempering Sand," by Mr. Max Sklovsky.

"Some Examples of the Relation between the Formation of Sand Deposits and their Physical Character," by Mr. D. W. Trainer.

"Testing Apparatus," by Mr. T. S. Adams.

"Wage Limitations, Group Bonus Plans," by Mr. B. R. Mayne.

"Heat Treatment of White Cast Iron," by Mr. Anson Hayes.

"Heat Treatment of White Cast Iron," by Mr. C. H. Lorig.

Report of Committee on Specifications for Malleable Castings.

"Nickel in Cast Iron," by Mr. P. D. Merica.

"Oxygen in Cast Iron," by a Representative of the United States Bureau of Standards.

"Relations between the Engineering Properties and the Constitution of Cast Iron," by Mr. J. W. Bolton.

"Influence of Phosphorus on the Total Carbon Content of Grey Iron," by Mr. James T. Mackenzie.

"Dilatometric Study of Graphitisation," by MM. Albert Portevin and Pierre Chevenard, Paris. Annual Exchange Paper, Association Technique de Fonderie de France.

Report of Sub-Committee on Geological Survey.

"Practical Tests of Sand," by Messrs. H. W. Dietert and W. M. Myler.

"Laboratory Testing of the Life of Sand," by Mr. C. R. Nevin.

"Superheating Iron in the Cupola," by Mr. S. J. Felton.

"Effect Produced by Changing Size of Cupola Tuyeres," by Mr. J. Grennan.

"Quality of Core Oils," by H. L. Campbell.

The Basset Process.—The production of steel by the Basset process direct from ore resulted in a loss of 536,000 francs to the shareholders of the Basset Company in 1924. Besides difficulties arising from the lack of suitable lining for resisting chemical and thermal reactions in the rotary furnace, the Dennemont works, where the work was carried on, did not lend themselves to high production, as remoteness from the source of coal and ore added to the expense. For continuing the work, a site has now been selected in Mortain, in the Manche Department, in the neighbourhood of iron mines. It is expected that the new plant will go into operation this year. At the existing works, 450 to 500 tons per month was produced, while in the new plant the monthly output is expected to average 2,500 to 3,000 tons. Mr. Basset claims that the steel produced by his process costs 35 to 40 per cent. less than steel as normally manufactured, and that its quality is equal to that of crucible steel.

The "VULCANIA" PATENT WHEEL MOULDING MACHINE.

Patent No. 5049.

THE "VULCANIA" PATENT WHEEL MOULDING MACHINE is for moulding spur wheels with straight, sloping or Vee-shaped teeth, also bevel wheels, skew gear wheels, worm wheels and internal wheels. The machine head is carried on a pillar which is held in a base-plate bedded in the floor sand, and is made to slide on the pillar by means of a lever and link carried on a joint bearing, or by rack and pinion, or screw if thought advisable for the particular work it is being used for.

An adjustable stop collar is provided for accurately deciding the depth of mould. On the removable head a slide is carried for supporting the patterns of the teeth to be moulded. This slide is made adjustable by screw or pinion gearing to the diameter required. The number of teeth to be moulded is decided by a special dividing plate into which a steel wedge or finger engages. The special dividing plate has milled vees, at the angle of 60° inclusive, around its circumference, to receive the steel wedge, which is adjusted by a screw having an internal spring to keep it in tension and to lock the head when ramming operations are being carried out.

JAMES EVANS & CO., BRITANNIA WORKS,
(MANCHESTER), LIMITED,
BLACKFRIARS, MANCHESTER.

Trade Talk.

GAIN, ORR & BRETT, LIMITED, have removed to 9-10, Fenchurch Street, London, E.C.3.

A FIRE OCCURRED at the works of R. Sorby & Sons, Trafalgar Street, Sheffield, but was extinguished before any damage was done.

AS THE RESULT of a fire, the works of the Hallamshire Steel & File Company, Limited, Sheffield, were closed for a few days. The blaze was extinguished before much damage was done.

SLIGHT DAMAGE was caused by a fire at the works of William Jessop & Sons, Limited, Brightside Lane, Sheffield, recently. The rolling mill, in which men were working at the time of the outbreak, was put temporarily out of action.

THE ORDER of the Cleveland Bridge and Engineering Company, Limited, Darlington, for alterations and additions to the goods station at Paddington includes a new steel-framed building 620 ft. by 183 ft., with a height of approximately 30 ft.

IN VIEW of the continued scarcity of orders, Wm. Gray & Company, Limited, are now closing their Wear shipyard at Sunderland. All the building berths at this yard are empty, and the last ship to be launched there is being sent round to the Hartlepools to be engined, and operations at the yard will then cease, pending further new business.

THE VISIBLE supply of tin at the close of July was 19,877 tons, against 19,535 at the end of June. The quantity of Straits and Australian on spot, landing and afloat to the United Kingdom is, however, smaller with a total of 6,033 tons, against 7,797 at the end of June. The quantity of tin afloat to the Continent is, on the other hand, larger, and afloat to the United States has increased about 1,400 tons to 8,244 tons.

THE MERSEY POWER COMPANY propose to install additional plant at their power station at Runcorn. The following orders have, we understand, been placed :—One 12,500-kilowatt turbo-generator, C. A. Parsons & Company, Limited, Heaton Works, Newcastle-on-Tyne; four 4,000-lb. boilers, Babcock & Wilcox, Limited, London; engine room and boiler-house buildings and condensing plant, G. & J. Weir, Limited, Cathcart, Glasgow.

THE CLYDE shipyard output was maintained at recent levels in July. The tonnage launched amounted to practically 31,000 tons, compared with 28,000 in July last year. The total is less by over 12,000 tons than that of June, but is 9,000 tons better than the output of May. For the year to date the Clyde output amounts to 333,888 tons, compared with 282,202 tons for the first seven months of last year. Contracts reported this month included two Blue Star liners of 12,000 tons dead weight at Clydebank, a steamer for Elders & Fyffes, and a screw tug for Australia at Linthouse, a sludge-carrying steamer for the London County Council at Dalmuir, and a steamer of 1,500 tons dead weight for the Limerick Steamship Company at Dundee.

THE MEMBERS of the Thirty Club, Windsor House, Westminster, entertained to dinner at the Rubens Hotel, on Wednesday, July 29, their fellow-member, Capt. W. E. Hinchley Cooke, on the occasion of his retirement from office as hon. treasurer of the club. Mr. W. F. Sadler, president of the club, was in the chair, and those present included Capt. H. E. P. D. Acland, Mr. H. S. Aspinall, Mr. R. M. Atkinson, Capt. F. C. Broome, Capt. R. D. Coath, Capt. S. Cockerell, Mr. P. F. Crinks, Mr. Seymour Darlington (hon. secretary), Mr. B. W. A. Dickson, Col. J. H. Dobson, Mr. A. Dunbar, Mr. J. L. Haworth, Mr. G. H. Hemsley, Major H. Jullerot, Mr. L. I. G. Leveson, Sq.-Ldr. H. J. Payn, Mr. R. P. Phillips, Mr. E. B. Sansom, Capt. O. H. D. Vickers, Major B. H. Winder, and Mr. F. C. Yapp.

Obituary.

MR. R. V. LINDABURY, chief counsel, director, and member of the executive committee of the United States Steel Corporation, died recently at the age of 75. He was one of the foremost authorities on anti-trust laws and litigation, and successfully defended the Corporation when the Government sought to dissolve it.

MR. H. L. WILLIAMS, a well-known engineer, died recently at the age of 52. The deceased was educated at Charterhouse and Trinity College, Cambridge, and thereafter qualified as an electrical engineer. He was one of the principals in the firm of Balfour, Beatty & Company since its inception in 1909, and, indeed, had been associated with Mr. George Balfour, M.P., the head of that firm, for some ten years previously. He was thus closely concerned in the electric supply and other public utility enterprises with which his firm were identified, and did much to assist in their successful development.

Contracts Open.

Dundee.—100 tons of steel tramway rails, for the Dundee Town Council. Mr. G. Baxter, city engineer, City Engineer's Office, 91, Commercial Street, Dundee.

Selby, August 15.—Cast-iron and steel water mains, valves, hydrants and special castings, etc., also for carting, laying and jointing of same, for the Selby R.D.C. Mr. J. Townend, clerk, 1, Abbey Place, Selby.

Bournemouth, August 26.—600 tons rails, section B.S.S. No. 4 (silicon steel), for the Tramways Committee. Mr. I. Bulfin, general manager, Wootton Gardens, Bournemouth. (Fee, £2 2s., non-returnable.)

London, S.E., August 21.—(1) Axle boxes, (2) helical draw and buffing springs, (3) wheels and axles, and (4) axles, for railway carriages and wagons, for the India Store Department. The Director-General, India Store Department, Branch No. 14, Belvedere Road, Lambeth, S.E.1.

Aberdare.—(1) Bar and other iron; (2) bolts, nuts, rivets, etc.; (3) gunmetal fittings; (4) colliers' tools; (5) ironmongery; (6) steel girders, channels and rails; (7) nails; (8) cast steel, tram wheels, axles, etc.; (9) steam and "Williams" joint tubes and fittings; (10) chains; (11) wire ropes, etc.; for the Powell Duffryn Steam Coal Company. The Stores Manager, Aberaman Offices, Aberdare.

Bulawayo, September 29.—Supply and erection of one motor-driven centrifugal feed pump and one Weir-type feed pump; one iron hotwell and fittings, with relative piping; one complete high-pressure steam range; one Green's economiser, or alternatively, (b) tubular air preheater, or (c) any other variety of air preheater (Contract C), for the Municipality. The Department of Overseas Trade (Room 48).

Gazette.

THE SHAREHOLDERS of Gwynnes, Limited, have decided to wind up the company voluntarily. Mr. C. A. Fryer, 3, London Wall Buildings, E.C.2, has been appointed liquidator.

THE MITCHAM FOUNDRY COMPANY, LIMITED, are being voluntarily wound up, Mr. J. J. Ure, 59-61, New Oxford Street, London, W.C.1, having been appointed liquidator. A further announcement appears on page 132.

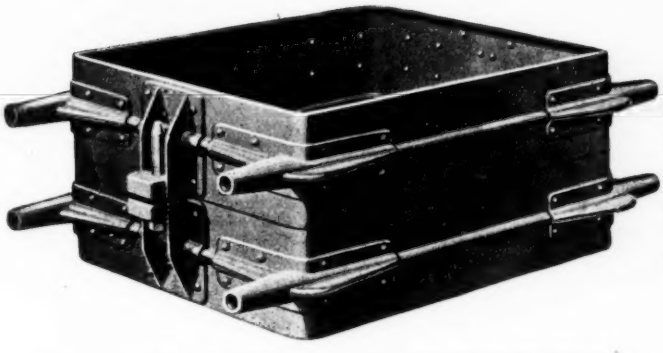
THE PARTNERSHIP heretofore subsisting between Messrs. L. Cohen and S. Cohen, carrying on business as iron, metal and general merchants, at Rhodeswell Wharf, Carr Street, Stepney, E., under the style of S. Cohen & Sons, has been dissolved.

Darlington Forge, Limited.—The sixth annual meeting was held at Darlington, SIR THOMAS PUTNAM, the chairman of the company, presiding. The chairman, in moving the adoption of the report, said that the amount due to the bankers had been secured by a second debenture for £160,000, which not only covered the company's overdraft, but also was a provision for the contingent liability due to the guarantee of the Carnforth overdraft and a provision for additional working capital. The shareholders would notice that expenditure on additions for the year ending March 31 last was £9,073 odd, against £4,700 the previous year. The extra sum was due to adding the manufacture of bronze casting. The extra capital addition for bronze castings was due to utilising one of the large buildings left over after the war, with its accompanying cranes and outfit, for the purpose of the manufacture of bronze and gunmetal castings. That addition to their manufactures was necessitated owing to the fact that they found cast steel propellers and propeller blades were being almost entirely superseded by bronze propellers and propeller blades. Having the necessary buildings and cranes already on their hands, and not occupied or producing anything, it was thought advisable to utilise them for that purpose, particularly so as all the heavy steel boxes in which the castings were made were considerable in number and costly, and also all the other machinery for finishing such work, and which they used previously for cast steel, could be brought into operation again on manganese bronze. In addition to that, they had as much as £12,000 worth of gunmetal liners in one year, which had to be purchased outside partly machined. These they were now making themselves, and doing the necessary machining on the lathes that would otherwise be standing. The actual extra cash expenditure on the plant during the past twelve months was £5,235, and that had been brought into productive operation, buildings and plant standing in their books at £27,220, which were previously idle, in addition to finding further employment for many machine tools previously only partially employed. Manufacture was commenced in January last, and output had been gradually increasing.

Sterling

STERLING
MOULDING BOXES

MADE FROM SPECIAL ROLLED CHANNEL STEEL.



LIGHT, STRONG, DURABLE. PERMANENTLY ACCURATE.

ARE MADE TO SUIT THE JOB

STERLING FOUNDRY SPECIALTIES LTD. BEDFORD
LONDON OFFICE, 13, VICTORIA STREET, S.W.1.

GANISTER, CUPOLA BLOCKS, FIRE BRICKS,
FIRE CLAY.

Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.

STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

J. GRAYSON LOWOOD & Co., Ltd.
DEEPCAR, nr. SHEFFIELD.
Telegrams: "LOWOOD, DEEPCAR."

SIEMENS' STEEL PROCESS

BOILER, SHIP and BRIDGE PLATES, etc. ANGLES and all forms of Sectional Bars. TYRES and AXLES to all requirements. CASTINGS of all kinds and of Largest Sizes. FORGINGS of every description. BILLETS, BLOOMS, RAILS.

SPECIAL STEEL FOR CONSTRUCTIVE PURPOSES.

The STEEL COMPANY OF SCOTLAND, Ltd.

Head Office: 23, ROYAL EXCHANGE SQUARE, GLASGOW.
Works: HALLSIDE, NEWTON and BLOCHAIRN, GLASGOW.
CONTRACTORS TO HOME, COLONIAL AND FOREIGN GOVERNMENTS.
Established 1872. *Telegraphic Address: "Steel, Glasgow."*

IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—There are, as yet, no signs of reaction from the prevailing stagnation general throughout the pig-iron industry, and on Tees-side during the current month little change is anticipated from the conditions now ruling. Later on, in the autumn, doubtless, there should be a revival of buying on a more extensive scale, but for the present the output of the twelve furnaces now in blast in Cleveland is amply sufficient for consumers' needs. One the export side, also, business is equally stagnant, the shipments of pig-iron from the Tees last month having totalled 24,834 tons, of which 14,673 tons went abroad and 10,161 tons coastwise. These are the lowest monthly figures recorded this year, but the manufactured iron and steel shipments showed some improvement, the total of 50,450 tons comparing with 44,060 tons in June. Prices remain nominally unaltered, but are, of course, subject to modification when fair-sized parcels are discussed, quotations ruling at 71s. per ton for No. 3, G.M.B., No. 1 75s., No. 4 foundry 70s. 6d., and No. 4 forge 70s. per ton.

A slightly better tone has been marked in the hematite market, but business, on the whole, is limited in volume, with prices still on the down-grade. East Coast mixed numbers being quoted at 76s. per ton, and No. 1 at 76s. 6d. In the North-West area quotations are nominal, as follow:—Bessemer mixed numbers, £4 5s., c.i.f. Welsh ports, £4 7s. 6d. per ton delivered at Glasgow, £4 10s. per ton delivered at Sheffield, and £4 15s. per ton delivered at Birmingham.

LANCASHIRE.—Most of the foundries in the district having closed for the annual holiday, business in the local pig-iron market is also at a standstill, with prices somewhat indefinite, Derbyshire No. 3 ruling nominally 77s. 6d., delivered local, while some Lincolnshire brands are offering at 76s. 6d. to 77s. per ton.

THE MIDLANDS.—Many consumers in this locality having ordered more fully of late, in view of threatening labour troubles, there is now little business moving in the local markets, prices being as follow:—Derbyshire No. 3 foundry, 70s. to 71s.; Staffordshire No. 3 foundry, 70s. to 72s. 6d.; Northants. No. 3 foundry, 65s.

SCOTLAND.—Amongst the engineering founders in the district there is still an acute lack of orders, and consequently their consumption of pig-iron is very small. Prices are unchanged at 81s. 6d. for No. 3 Scotch foundry at the furnaces, and 75s. for No. 3 Middlesbrough at Grangemouth.

Finished Iron.

Manufacturer's order books, at present, are extremely poor in all branches, but more especially for crown and the cheaper grades of iron. Quotations remain stationary, marked bars being £14 10s. at makers' works, crown £12 7s. 6d. delivered, and bolt and fencing iron at £11 7s. 6d. There has been a noticeable advance in the price for French and Belgian nut and bolt iron, which for weeks has been round about £6 12s. 6d., delivered here. It is now quoted at £7 and £7 2s. 6d., delivered. Even at this figure it is certain that the bulk of the local business will go abroad, as the disparity is too great to allow of the local ironworks to get preference.

Steel.

Business in the Sheffield market for steel products continues quiet, but in the Midlands manufacturers are reported to have better order books than has been the case for some time, although the increased business is almost entirely for the bar mills. Orders for sectional material and joists are very scarce, and the steelworks here are having to meet exceptional competition from the N.E. Coast makers. As reported last week, the basis price of £8 for angles and joists has been broken, and orders for heavy tonnage could be placed at £7 17s. 6d. The general price, however, would be £8 to £8 5s. for miscellaneous specifications. There is keenness for plate orders, and £8 15s. basis is being accepted in several quarters to get business. On the tinplate market prices are easy all round: 18s. 9d. is being accepted readily, but many makers are holding out for 19s. and upwards.

Scrap.

No improvement can be noted in scrap metal conditions, demand for all descriptions of material being at a minimum, with prices invariably tending to lower levels. In Lancashire there seems to be plenty of the ordinary qualities of cast scrap about, which can be had at 72s. 6d., or at most 75s. per ton, delivered, but fine lots of broken textile machinery, or "loom" scrap, are not plentiful, and when this material is wanted, up to 82s. 6d. per ton has to be paid. In Scotland prices are still nominal, as consumers do not show any anxiety to buy, as the stocks at their works are quite ample to enable them to carry on for a little in the event of them kindling up again at an early date. Quotations at present, delivered consumers' works, are as follow:—Heavy turnings, 52s. 6d. to 65s.; cast-iron borings, 47s. 6d. to 50s.; machinery cast-iron, 77s. 6d.; ordinary cast iron, 70s. to 72s. 6d.; old cast iron railway chairs, 77s. 6d.; and light cast iron and firebars, 55s.

Metals.

Copper.—A somewhat more buoyant feeling has predominated in this section of the market of late, based, it may be presumed on the policy of restricted outputs in America, now in force. The advance in values so far has only shown slow progress, but this is due to the unsettled industrial outlook in this country and on the Continent. British copper interests recently bid for a large quantity of American refined copper at a little under 14 cents., but this was refused, and there does not seem to be much secondhand material on the market. Current quotations:—*Cash*: Thursday, £62 12s. 6d.; Friday, £62 15s.; Monday, £63 5s.; Tuesday, £63; Wednesday, £62 7s. 6d.

Three Months: Thursday, £63 12s. 6d.; Friday, £63 15s.; Monday, £64 2s. 6d.; Tuesday, £64; Wednesday, £63 7s. 6d.

Tin.—Some fairly heavy shipments of tin have been in evidence from British ports to America of late, and this, combined with good buying on home account has considerably strengthened the market position. We are still in the midst of the holiday season, and thus the time is not favourable to any important movement, but it is quite likely that later on, when interest in rubber has subsided a little, tin will have its turn, as the two commodities often work forward side by side. Current quotations:—*Cash*: Thursday, £263 15s.; Friday, £264 5s.; Monday, £262 10s.; Tuesday, £261 10s.; Wednesday, £258 10s.

Three Months: Thursday, £266 5s.; Friday, £266 15s.; Monday, £265 2s. 6d.; Tuesday, £264; Wednesday, £261 5s.

Spelter.—A merchant's view of the market position states:—There is very little in the present situation of this metal to warrant sustained advance, for demand on the part of consumers in this country remains disappointing, nor has any improvement taken place on the Continent. In the U.S.A. the market has remained firm, and export metal has not been pressed for sale. The future, therefore, is likely to be governed by the position in America. Current quotations:—*Ordinary*: Thursday, £36 11s. 3d.; Friday, £36 15s.; Monday, £36 12s. 6d.; Tuesday, £36 8s. 9d.; Wednesday, £36 5s.

Lead.—In the market for soft foreign pig, there is rather more doing for Continental account, and it is anticipated that further metal will be required for Russia, as it is known that that country intends to make more extensive purchases of all commodities here very shortly. In view of the unsettled industrial outlook some caution should be observed, but, apart from this, lead looks perfectly sound and healthy. Current quotations:—*Soft foreign (prompt)*: Thursday, £38 7s. 6d.; Friday, £37 17s. 6d.; Monday, £37 10s.; Tuesday, £37 5s.; Wednesday, £36 18s. 9d.

Accident in Birmingham Foundry.

Last Tuesday, four foundry workers, Thomas Jevvett, Herbert Clifton, Harry Pearce and Edwin Horton, were carrying a ladle of molten metal at the Smethwick Works of Messrs. Muntz Metal Company, when one of them slipped, causing a serious splashing of the liquid, which resulted in the severe burning of the men, especially two first named.

Mr. G. H. Clarner, a past-president of the American Foundrymen's Association, who headed the American delegation which visited Paris in 1923, is at present in Europe.

The . . .

STAVELEY COAL & IRON CO.,

LIMITED.

Works and Head Office:

STAVELEY WORKS, near CHESTERFIELD.

Telegraphic Address: "STAVIRON, BARROWHILL." *Telephone: 251 CHESTERFIELD (Pote. Bnch. Ex.)*

London Office: CROWN HOUSE, ALDWYCH, W.C.2.

Telegrams: "STAVIRONCO, ESTRAND, LONDON." **Telephone: REGENT 4846 (2 lines).**

WEST OF ENGLAND AND SOUTH WALES OFFICE:
3, Edmund Street, Birmingham.
Telegraphic Address: "PARSTESCO, BIRMINGHAM."
Telephone: 7378 CENTRAL.

MANCHESTER OFFICE:
Grosvenor Chambers, Deansgate.
Telegraphic Address: "STAVIRON, MANCHESTER."
Telephone: 597 CITY.

SHEFFIELD OFFICE:
The White Building, Fitzalan Square, Sheffield.
Telegraphic Address: "STAVIRON, SHEFFIELD."
Telephone 1531 SHEFFIELD.

Pig-Iron Manufacturers.

Suitable for all

GENERAL FOUNDRY PURPOSES.

Brands: STAVELEY and RINGWOOD.

The Services of our expert Metallurgical Staff are at Buyers' disposal.
We are prepared to advise suitable mixtures, for all foundry purposes.

CAST IRON PIPES

of all sizes for Water, Gas, Steam and Hydraulic Pressure.

WOOD WOOL

for Filtration, Packing and other purposes.

Chemical Manufacturers:

Aniline Oil,
Aniline Salt,
Naphthaline Balls,
Naphthaline Tablets,
Hot Pressed Naphthalene,
Naphthalene Flakes,
Naphthalene Powder,
Cresylic Acid,
Crude Carbolic Acid,
Nitre Cake,
Salt Cake,
Pyridene
Sulphate of Copper,
Sulphate of Iron,
Red Oxide of Iron,
Bleaching Powder,
Caustic Soda,
Accumulator Acid,
Creosote Oil,
Green Oil, Pitch,
Sulphate of Ammonia,
Muriate of Ammonia,
B.O.V. & R.O.V.
Oleum (all strengths),
Pure Sulphuric Acid,
Nitric Acid,
Disinfectant Powder.

TARRED SLAG.

"STAVEHO" for Waterproofing Cement Work.

YOUR ENQUIRIES ARE INVITED.

ON ADMIRALTY, WAR OFFICE, CROWN AGENTS AND INDIA OFFICE LISTS.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	62	7	6
Three months	63	7	6
Electrolytic	67	15	0
Tough	64	15	0
Best selected ..	65	5	0
Sheets	92	0	0
India	80	0	0
Wire bars ..	68	15	0
Do. Aug-Sept.	66	10	0
Do. Aug-Sept.	66	10	0
Ingot bars ..	68	10	0
H.C. wire rods	73	0	0
Off. av. cash, July	61	10	7 3/16
Do., 3 mnths. July	62	10	5 5/16
Do. Sttlmnt, July	61	10	6 1/16
Do., Electro, July	66	0	0
Do., B.S., July	64	0	10
Aver. spot price copper, July	61	10	6½
Do., wire bars, July	66	5	0
Solid drawn tubes			13½d.
Brazed tubes ..			13½d.
Wire			9¾d.

BRASS.

Solid drawn tubes	12d.
Brazed tubes ..	13½d.
Rods, drawn ..	10½d.
Rods, extd. or rlld.	7½d.
Sheets to 10 w.g.	10½d.
Wire	10½d.
Rolled metal ..	9¾d.
Yellow metal rods	7½d.
Do. 4 x 4 Squares	8d.
Do. 4 x 3 Sheets	8½d.

TIN.

Standard cash	258	10	0
Three months ..	261	5	0
English ..	258	10	0
Bars	263	10	0
Straits	267	0	0
Australian ..	264	15	0
Eastern ..	271	10	0
Banca	267	10	0
Off. aver. cash, July	258	10	6 3/16
Do., 3 mths., July	260	17	6
Do., Sttlmnt. July	258	10	2 1/16
Aver. spot., July	258	10	2½

SPELTER.

Ordinary ..	36	5	0
Remelted ..	36	0	0
Hard	30	0	0
Electro 99.9 ..	41	0	0
English ..	36	15	0
India	31	5	0
Zinc dust ..	42	0	0
Zinc ashes ..	14	10	0
Off. aver., July	34	14	0 27/32
Aver., spot, July	34	17	10½

LEAD.

Soft foreign ppt.	36	18	9
English ..	38	5	0
Off. average, July	34	7	1 5/32
Average spot, July	34	13	11½

ZINC SHEETS, &c.

Zinc sheets, English	42	0	0
Do. V.M. ex whf.	42	0	0
Dutch			—
Rods	47	0	0
Boiler plates ..	41	0	0
Battery plates	40	0	0

ANTIMONY.

Special brands, Eng.	74	10	0
Chinese ..	65	0	0
Crude	53	0	0

QUICKSILVER.

Quicksilver ..	13	17	6

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro silicon
45/50% .. 13 2 6
75% 22 7 6
Ferro-vanadium—
35/40% 16/- to 17/- lb. va
Ferro-molybdenum—
70/75% c. free 7/- lb.
Ferro-titanium—
23/25% carbonless 1/-lb.
Ferro-phosphorus, 20/25%, £22 0 0
Ferro-tungsten—
80/85 %, c.fr. 1/7 to 1/8 lb.
Tungsten metal powder—
98/99% 1/10 to 1/11 lb.
Ferro-chrome—
4/6% car. .. £23 15 0
6/8% car. .. £23 0 0
8/10% car. .. £22 10 0
Ferro-chrome—
Max. 2% car. £42 17 6
Max. 1% car. £52 5 0
Max. 0.70% car. £56 5 0
70%, carbonless 1/5 lb.
Nickel—99%, cubes or pellets £170 to £175
Cobalt metal—98/99% 10/6 lb.
Aluminium 98/99% £118
Metallic Chromium—
96/98% .. 3/9 lb.
Ferro-manganese (net)—
76/80%, loose £15 10 0
76/80%, packed £16 10 0
76/80%, export £15 0 0
Metallic manganese—
94/96%, carbonless 2/-lb.
Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten ..	s. d. 2 6
Finished bars, 18% tungsten ..	3 0

Per lb. net, d/d buyers' works.
Extras—
Rounds and squares 3 in. and over .. 4d. lb.
Rounds and squares under ½ in. to ¼ in. 3d. lb.
Do. under ¼ in. to ⅛ in. .. .. 1/- lb.
Flats, ½ in. × ½ in. to under 1 in. × ⅛ in. 3d. lb.
Do. under ½ in. × ½ in. 1/-lb.
Bevels of approved sizes and sections 6d. lb.
Bars cut to length 10% extra

Scrap from high-speed tool steel—
Scrap pieces .. 3d.
Turnings and swarf 1d.
Per lb. net, d/d steel makers' works.

SCRAP.

South Wales—	£ s. d.	£ s. d.
Hvy. steel	3 2 6 to 3	5 0
Bundled steel &shrngs.	3 0 0 to 3	3 6
Mixed iron & steel	3 0 0 to 3	2 6
Heavy cast iron	3 5 0 to 3	7 6
Good machinery for foundries	3 10 0 to 3	15 0

Cleveland—		
Heavy steel ..	2	17 6
Steel turnings ..	2	4 6
Cast-iron borings	2	0 0
Heavy forge ..	4	0 0
Bushelled scrap	3	5 0
Cast-iron scrap	3 11 0 to 3	11 6

Lancashire—		
Cast-iron scrap..	3	12 6
Heavy wrought	3 12 6 to 3	15 0
Steel turnings ..	2	5 0

London — Merchants' buying prices delivered yard.

Copper (clean) ..	53	0	0
Brass (clean) ..	40	0	0
Lead (less usual draft)	32	0	0
Tea lead ..	27	0	0
Zinc	24	0	0
New aluminium cuttings ..	93	0	0
Braziery copper	48	0	0
Gunmetal ..	48	0	0
Hollow pewter ..	178	0	0
Shaped black pewter	130	0	0

PIG-IRON.

(f.o.t. unless otherwise stated).

N.E. Coast—	
Foundry No. 1 ..	74/-
Foundry No. 3 ..	70/-
Foundry No. 4 ..	69/6
Forge No. 4 ..	69/-
Hematite No. 1 ..	76/-
Hematite M/Nos. ..	75/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	87/6
,, d/d Birm. ..	95/-
Midlands—	
Staffs. common* ..	102/-
,, No. 4 forge ..	67/6
,, No. 3 foundry	71/3
Shrops. basic ..	75/-
,, Cold blast, ord.*	190/-
,, ,, roll iron*	195/-
* d/d Birmingham.	
Northants forge ..	58/6
,, fdry No. 3 ..	65/-
Derbyshire forge ..	65/-
,, fdry No. 3 ..	70/6
,, basic	72/6
Scotland—	
Foundry No. 1 ..	86/6
,, No. 3 ..	81/6
Hem. M/Nos. ..	83/6
Sheffield (d/d district)—	
Derby forge ..	69/-
,, fdry. No. 3 ..	74/-
Lincs. forge ..	68/-
,, fdry. No 3 ..	72/-
E.C. hematite ..	85/6
W.C. hematite ..	90/-
Lincs. (at furnaces)—	
Forge No. 4 ..	63/-
Foundry No. 3 ..	66/-
Basic	66/-
Lancashire (d/d eq. Man.)—	
Derby forge ..	73/-
,, fdry. No. 3 ..	77/6
Northants foundry No. 3 ..	78/-
Dalzell, No. 3 ..	111/6
Summerlee, No. 3 ..	99/-
Glengarnock, No. 3	99/-
Gartsherrie, No. 3 ..	99/-
Monkland, No. 3 ..	99/-
Coltness, No. 3 ..	99/-
Shotts, No. 3 ..	99/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.)	11 12 6 to 12	10 0
Angles	12	7 6
Tees to 3 united ins	13	2 6
Nut and bolt	11	15 0
Hoops	14 0 0 to 15	0 0
Marked bars (Staffs.) f.o.t...	14	10 0
Gas strip ..	13	0 0
Bolts and nuts, ¾ in. × 4 in. ..	16	15 0

Steel—		
Ship plates	8 10 0 to 9	0 0
Boiler plts.	£12 10 to 13	0 0
Chequer plts.	£ 9 15 to 10	5 0
Angles	£8 0 0 to 8	5 0
Tees	£9 0 0 to 9	5 0
Channels	£7 7 6 to 7	17 6
Joists	£8 0 0 to 8	5 0
Rounds and Squares 3in. to 5½in. ..	9	5 0
Rounds under 3 in. to ¾ in... ..	9	0 0
Flats, over 5 in. wide and up ..	9	15 0
Flats, 5in. to 1½in.	8	15 0
Rails, heavy ..	8	10 0
Fishplates ..	12	10 0
Hoops (Staffs.)	£11 0 0 to 11	10 0
Black sheets, 24g.	11	10 0
Galv. cor. sheets, 24g.	16	0 0
Galv. fencing wire 8g. plain ..	14	0 0
Billets, soft	6 10 0 to 7	15 0
Billets, hard ..	9	0 0
Sheet bars	6 12 6 to 6	15 0
Tin bars d/d	6 12 6 to 6	15 0

PHOSPHOR BRONZE

	Per lb.	basis.
Strip	1	3
Sheet to w.g. ..	1	3½
Wire	1	3¾
Rods	1	3
Tubes	1	8
Castings	1	2

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
3/0 to 10 G. ..	1/6½ to 2/1½

with extras according to gauge.

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	21.26
No. 2 foundry, Valley	20.26
No. 2 foundry, Birm.	18.00
Basic	19.76
Bessemer	20.76
Malleable	20.26
Grey forge	19.76
Ferro-mang. 80% d/d	115.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess. billets	35.00
O.-h. billets	35.00
O.-h. sheet bars ..	35.00
Wire rods	45.00
	Cents.
Iron bars, Phila. ..	2.22
Steel bars	2.00
Tank plates	1.90
Beams, etc.	2.00
Skelp, grooved steel ..	1.90
Skelp, sheared steel ..	1.90
Steel hoops	2.40
Sheets, black, No. 28 ..	3.15
Sheets, galv., No. 28 ..	4.20
Sheets, blue an'l'd, 9 & 10	2.30
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv. ..	3.35
Tinplate, 100 lb. box ..	$5.50

COKE (at ovens).

Welsh foundry ..	37/6
,, furnace	27/6
Durham & North.	
,, foundry ..	35/-
,, furnace ..	17/6
Other Districts, foundry	35/-
,, ,, furnace (Basis)	13/6

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes,	20 × 14, box	18/9-
,,	28 × 20, ,,	37/6
,,	20 × 10, ,,	27/9
,,	18¾ × 14, ,,	19/9
C.W.	20 × 14, ,,	17/11½
,,	28 × 20, ,,	34/9
,,	20 × 10, ,,	24/1½
,,	18¾ × 14, ,,	17/4½

Terneplates 28 × 20, 35/6 per box basis f.o.b.

SWEDISH IRON.

Bars, hammered	£19/0 to £20/0
Rolled Ord.	£16/0/0 to £16/10/0
Nail rods	16 5 0 to £16 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£10 to £14
Pig-iron	£6 15 0 to £7 0 0

all f.o.b. Gothenburg.

TUBES.

Up to and incl. 6 in.

Gas .. 55% } Tube prices
Water .. 50% } are
Steam .. 45% } now free.

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£	s.	d.	
Aug. 6	62	12	6	dec. 2/6
„ 7	62	15	0	No change
„ 10	63	5	0	inc. 10/–
„ 11	63	0	0	dec. 5/–
„ 12	62	7	6	„ 12/6

Electrolytic Copper.

	£	s.	d.	
Aug. 6	67	15	0	No change
„ 7	67	15	0	„ „
„ 10	68	5	0	inc. 10/–
„ 11	68	10	0	„ 5/–
„ 12	67	15	0	dec. 15/–

Standard Tin (cash).

	£	s.	d.	
Aug. 6	263	15	0	dec. 25/–
„ 7	264	5	0	inc. 10/–
„ 10	262	10	0	dec. 35/–
„ 11	261	10	0	„ 20/–
„ 12	258	10	0	„ 60/–

Tin (English ingots).

	£	s.	d.	
Aug. 6	264	0	0	dec. 20/–
„ 7	264	10	0	inc. 10/–
„ 10	262	10	0	dec. 40/–
„ 11	261	10	0	„ 20/–
„ 12	258	10	0	„ 60/–

Zinc Sheets (English).

	£	s.	d.	
Aug. 6	41	0	0	No change
„ 7	42	0	0	inc. 20/–
„ 10	42	0	0	No change
„ 11	42	0	0	„ „
„ 12	42	0	0	„ „

Spelter (ordinary).

	£	s.	d.	
Aug. 6	36	11	3	inc. 5/–
„ 7	36	15	0	„ 3 9
„ 10	36	12	6	dec. 2/6
„ 11	36	8	9	„ 3 9
„ 12	36	5	0	„ 3 9

Lead (English).

	£	s.	d.	
Aug. 6	39	0	0	inc. 5/–
„ 7	39	0	0	No change
„ 10	38	15	0	dec. 5/–
„ 11	38	10	0	„ 5/–
„ 12	38	5	0	„ 5/–

AVERAGE MONTHLY PRICES OF STEEL BOILER PLATES IN ENGLAND.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1895	5 15 0	5 15 0	5 12 6	5 12 6	5 15 0	5 17 6	5 15 0	5 17 6	6 0 0	6 0 0	6 2 6	6 0 0	5 16 10½
1896	6 0 0	6 0 0	6 2 6	6 2 6	6 2 6	6 0 0	6 0 0	6 0 0	6 0 0	6 2 6	6 10 0	6 10 0	6 2 6
1897	6 10 0	6 10 0	6 10 0	6 7 6	6 2 6	6 2 6	6 5 0	6 0 0	6 0 0	6 0 0	6 7 6	6 10 0	6 5 5
1898	6 10 0	6 8 9	6 8 9	6 10 0	6 15 0	6 18 9	6 17 6	6 17 6	7 2 6	6 15 0	7 0 0	7 5 0	6 15 8½
1899	7 5 0	8 0 0	8 2 6	8 2 6	8 5 0	8 5 0	8 12 6	8 12 6	8 15 0	8 15 0	9 2 6	9 5 0	8 17 8½
1900	9 5 0	9 5 0	9 7 6	9 10 0	9 12 6	10 5 0	10 5 0	10 5 0	10 5 0	10 0 0	9 15 0	9 15 0	9 15 10
1901	9 5 0	9 5 0	8 15 0	8 10 0	8 10 0	7 10 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	8 3 11
1902	7 7 6	7 0 0	7 12 6	7 12 6	7 12 6	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 9 7
1903	7 10 0	7 10 0	7 15 0	7 5 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	6 17 6	7 3 11½
1904	6 12 6	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 11½
1905	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 10 0	7 5 0	8 0 0	8 0 0	7 1 3
1906	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 0 10
1907	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 0 0	8 0 0	8 8 4
1908	7 10 0	7 10 0	7 10 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 3 9
1909	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 15 0	6 15 0	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 9
1910	7 0 0	7 0 0	7 1 3	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 10 0	7 10 0	7 10 0	7 5 1
1911	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 14 0	7 10 4
1912	7 18 9	8 0 0	8 0 0	8 7 6	8 10 0	8 10 0	8 10 0	8 15 0	8 16 3	9 0 0	9 2 0	9 5 0	8 11 2½
1913	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	8 19 0	8 15 0	8 5 0	7 15 0	7 15 0	8 17 0
1914	7 15 0	7 15 0	7 15 0	7 13 9	7 10 6	7 5 0	7 0 0	8 0 0	8 2 6	8 5 0	8 5 0	8 5 0	7 15 11½
1915	8 14 0	9 10 0	9 17 6	10 10 0	10 10 0	11 0 0	11 0 0	11 0 0	11 0 0	11 4 0	12 0 0	13 0 0	10 15 5½
1916	13 0 0	13 0 0	13 0 0	12 15 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 12 11
1917	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1918	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1919	13 0 0	15 0 0	15 0 0	15 0 0	19 5 0	19 17 6	21 0 0	21 10 0	21 10 0	21 10 0	21 15 0	23 10 0	18 9 9
1920	26 0 0	28 0 0	28 5 0	28 10 0	29 5 0	30 0 0	30 0 0	30 0 0	30 10 0	31 0 0	31 0 0	31 0 0	29 9 2
1921	30 5 0	29 0 0	25 0 0	25 0 0	25 0 0	23 0 0	21 0 0	20 10 0	19 0 0	17 10 0	16 0 0	14 16 0	22 1 9
1922	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	13 1 8	13 10 0	12 15 0	12 10 0	12 10 0	12 10 0	12 6 0	13 10 9
1923	12 8 9	13 6 0	14 0 0	14 0 0	14 0 0	14 0 0	13 12 6	13 0 0	13 0 0	13 0 0	13 0 0	13 10 0	13 9 1½
1924	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	14 0 0	14 0 0	13 11 0	13 5 0	13 5 0	13 10 11
1925	13 5 0	13 5 0	13 5 0	13 1 0	12 15 0	12 15 0	12 15 0	—	—	—	—	—	—

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18, BENNETTS HILL, BIRMINGHAM.
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SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 7 words per line. Minimum charge for one insertion 3/-.

SITUATIONS VACANT AND WANTED.

FOUNDRY FOREMAN and Manager of 15 years' experience in above capacity, up-to-date in modern Foundry practice, green and dry sand, loam, oil sand, strickle and machines, jolt-ram, etc.; 46 years of age; winner of Sir John Brunner Scholarship; energetic, can control men, and good organiser; good references; would be pleased of change.—Box 406, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

MR. W. H. MEADOWCROFT, M.I.Brit.F., of 72, Elliott Street, Tyldesley, near Manchester, having had extensive experience in the management of IRON FOUNDRIES, wishes to get in touch with OWNERS or FOUNDRY SUPPLY and EQUIPMENT MANUFACTURERS, who could utilise his extensive experience in the practical and technical control of large foundries to mutual advantage.

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FOREMAN PATTERNMAKER or Foundry Superintendent requires post; age 48; expert machine moulding ideas, modern and economic methods; excellent record; good references; energetic; able to control men.—Box 412, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

SANITARY WARE MANUFACTURERS.—Manager of large Enamel-ware Factory in United States of America, desirous of returning to Great Britain, would like to communicate with any firm desiring his services.—Box 410, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

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GENTLEMAN, with a practical knowledge on Foundry productions, with a wide connection with Foundries, seeks position as Traveller on Foundry Requisites, Moulding Machines and Plant, etc.—Box 416, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

EX-OFFICERS AND OTHER RANKS.

The Proprietors of the FOUNDRY TRADE JOURNAL have placed this space at the disposal of the British Legion, Officers' Association, Employment Bureau, 3-4, Clement's Inn, Strand, London, W.C.2. (telephone: Holborn 5769), to whom all replies should be addressed, quoting number of advertisement, date on which it appeared, and the name of this paper.

MOTOR SALESMAN or Traveller, age 42, married, war service, thorough knowledge of workshop maintenance, upkeep and organisation of motor transport vehicles, thorough business training and commercial abilities, extensively travelled, used to responsibility, desires any post, preferably in charge of a fleet of transport vehicles, or as Motor Salesman or Traveller. (00011.)

DISABLED EX-OFFICER (Infantry), with only very moderate pension, is in urgent need of work; no offer refused; age 37; tall and strong; South preferred. (Dis. 13.)

EX-ADMINISTRATIVE OFFICIAL, Finance Department, Mandatory Territories, seeks re-engagement, any position of trust; not afraid of responsibility; specially recommended by High Commissioner; would accept six months' trial at low salary to prove efficiency; first-class commercial experience; overseas prior to war; accounts, general management, etc.; single; go anywhere. (00067.)

AGENCY.

A WELL-KNOWN Foundry Equipment Company, manufacturing up-to-date foundry equipment and specialities for higher foundry efficiency, is desirous of appointing Agents, on a sole selling commission basis, in several districts throughout Great Britain, and also for each British Colony. — Applicants are invited to give full particulars as to experience, and ground covered, etc., Box 380, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

MACHINERY.

FOR SALE.—20-in. and 24-in. Hall's Invincible Sand Mixers; the original and best machine in the market for mixing old and new Foundry Sand, Coal Dust, etc.—Apply PENNEY & PORTER (ENG.), LTD., Lincoln.

FOR SALE, at a low price, 2-ton RENNERFELT STEEL MELTING FURNACE, with Transformers, Motor, Switches, Busbars, Cable, Carbon Holders and Gear; in good condition. Same may be inspected in the North-East of England.—Apply, Box 408, Office of THE FOUNDRY TRADE JOURNAL, 5, Duke Street, Adelphi, London, W.C.2.

SAND MIXERS.—New and secondhand. Ask us to quote.—W. BREALEY & COMPANY, LTD., Russell Street, Sheffield.

USED FILES WANTED.—In lots of 5 cwt. minimum; best prices f.o.r. your station.—ED. H. RONNEBECK & COMPANY, Halifax Buildings, Middlesbrough.

MISCELLANEOUS.

PATTERNSHOP SUPPLIES.—Dowels, Rapping and Lifting Plates, Pattern Letters, etc.; all sizes. Immediate deliveries ex large stocks.—Send your inquiries to LAWSON, WALTON & CO., LTD., St. Nicholas Buildings, Newcastle/Tyne.

PATTERNS.—Inquiries solicited; quotations by return; quick delivery. Castings also supplied, if required, in all metals.—CLEGHORN & CO., Spring Gardens, Worcester.

"THE FOUNDRYMAN'S EDUCATOR" should be possessed by all Foundrymen; gives mixings of non-ferrous metals and irons, advice on productions; helps you to secure better positions; make a move; post free 6s.—"FOUNDRYMAN'S EDUCATOR" Offices, Harefield Hall, Heywood, Lancs.

BE BRITISH! BUY BRITISH GOODS!—The Doric Flux, the safest and the only reliable Flux on the market for the Foundryman; our sales are now double since we first manufactured a Brassfounders' saver and better castings, an Iron and Steel Founders' liquidiser, cleanser of sulphur and phosphorous, ensuring sound castings; no foundry should be without it; reduce your losses and your costs.—Manufactured by THE LANCASHIRE METAL FLUX WORKS, Heywood, Lancs. Agents for South Wales and West of England: SANDERS & COMPANY, Alston Works, Newport (Mon.).

LADLES

25 Cwt. EVANS new	£24
2 Ton EVANS good	£28
5 Ton EVANS new	£42

CUPOLAS

1 Ton EVANS as new	£35
5 Ton THWAITES as new	£70
7 Ton THWAITES as new	£110

ALEX. HAMMOND,
FOUNDRY MACHINERY MERCHANT,
"BOXTED," SLOUGH